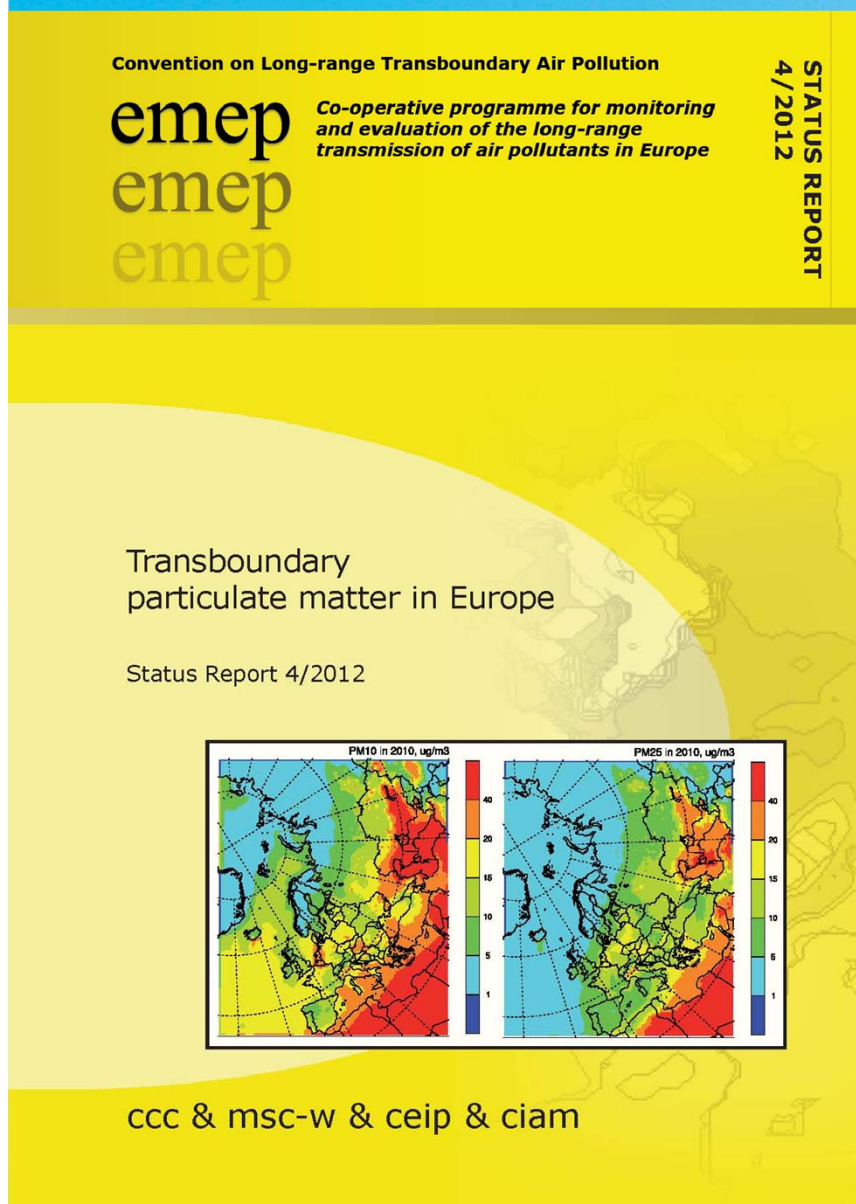


EMEP PM Status 2010 and workplan 2013



EMEP Status report 4/2012:

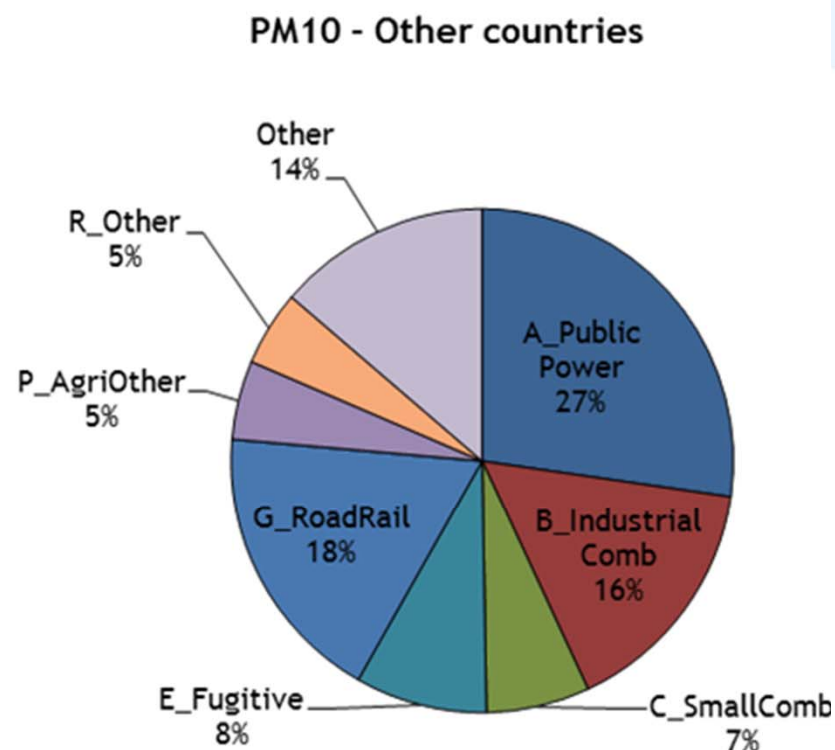
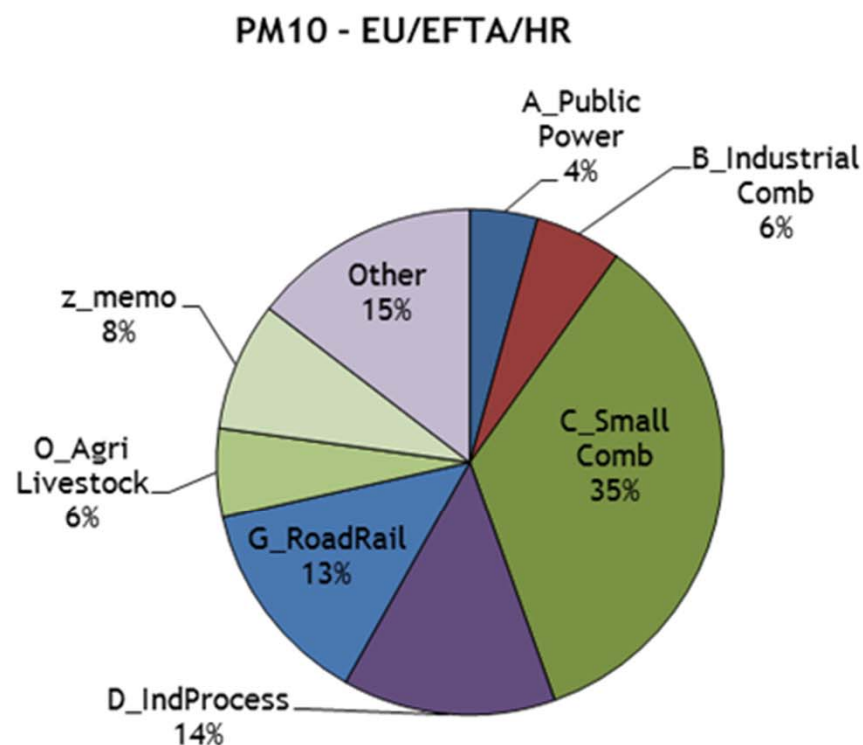
1. Emissions 2010
2. Revision of the Gothenburg Protocol
3. Measurements and modelling 2010
4. EMEP and the EU Project ACTRIS
5. Volcanic aerosols from the Eyjafjallajökull eruption

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G.N Kouvarakis (Univ. of Crete)
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G. Pappalardo (IMAA-CNRI)
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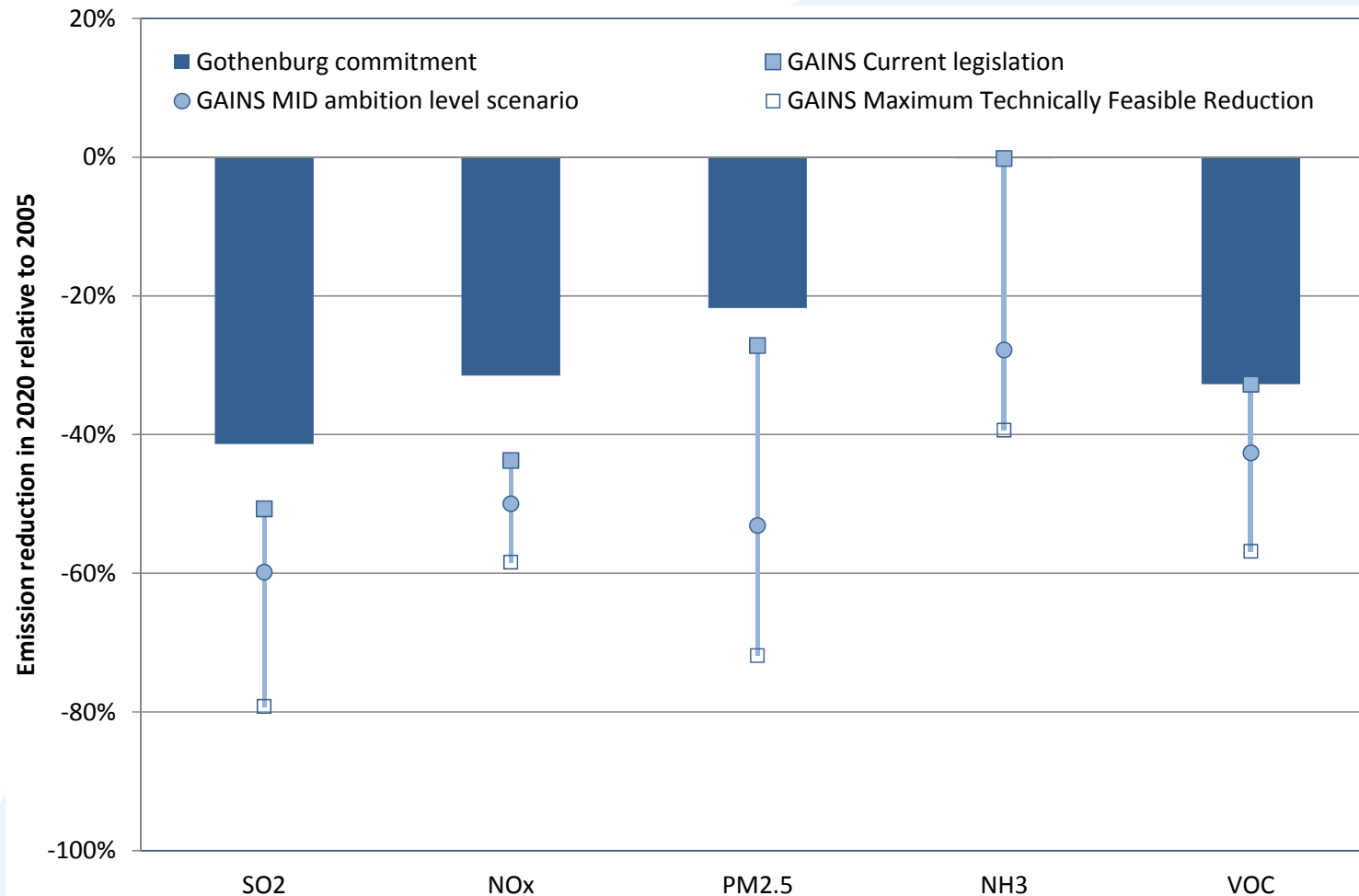


Top seven categories contributing to PM₁₀ 2010 emissions (GNFR categories).



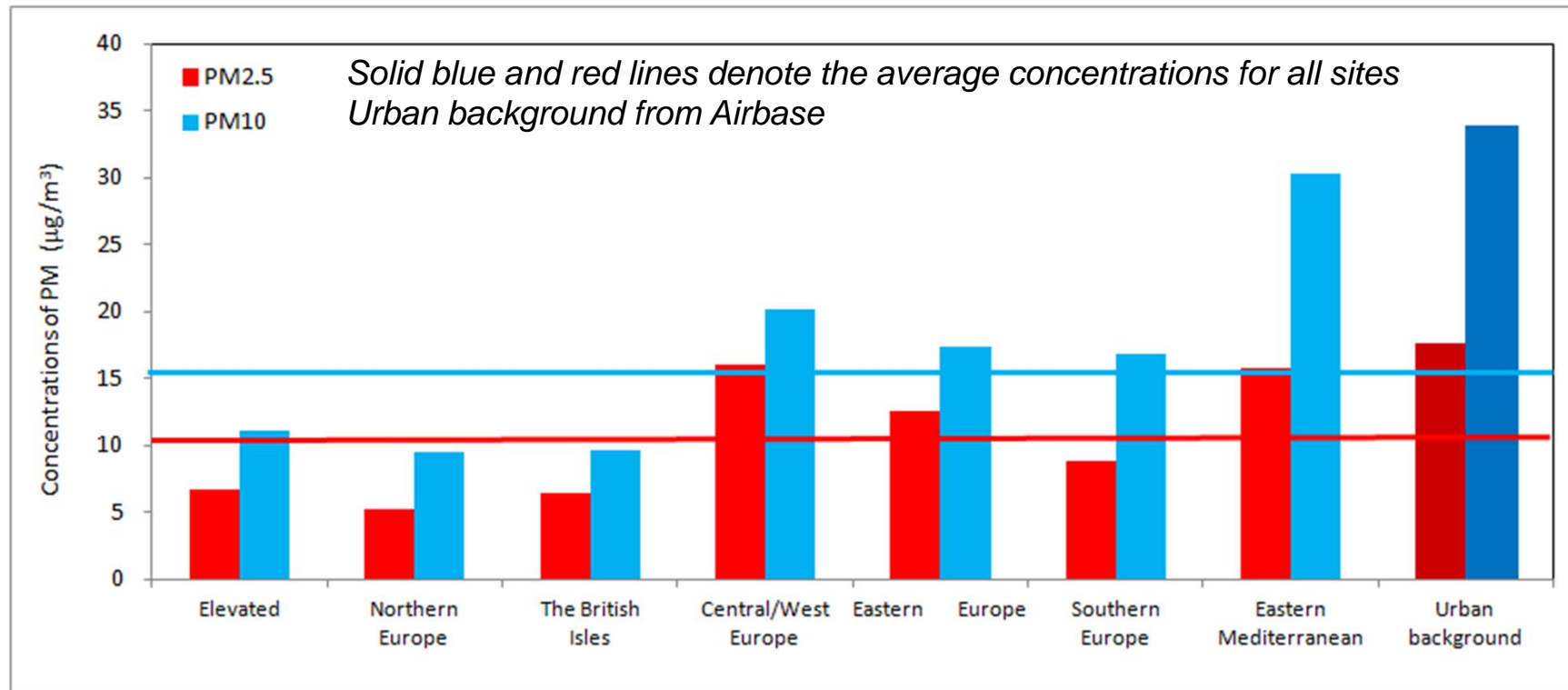
The number of Parties providing PPM was 36; out of 51 Parties to the Convention. One more 2010 compared to 2009. Rather limited information is provided for Turkey, Central Asia and the Caucasus regions.

Revision of the Gothenburg protocol



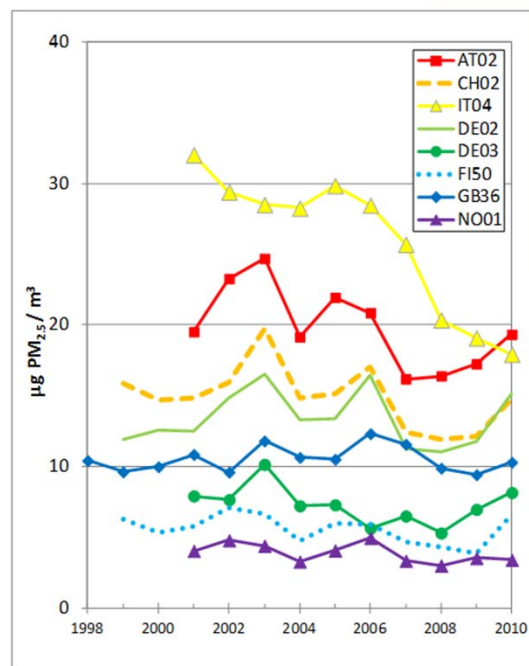
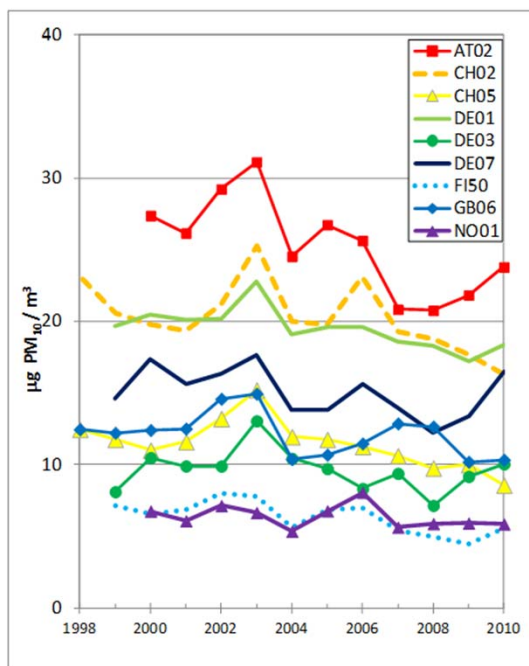
Changes in emissions in 2020 relative to 2005 over the EMEP domain. The commitments are indicated by the blue bars, while the lines indicate the ranges between the 'current legislation' and the 'maximum technically feasible reduction'

PM₁₀ and PM_{2.5} concentration , 2010



- ❖ 69 sites (67 for PM₁₀ and 43 for PM_{2.5}); four more than in 2010.
- ❖ mean regional background PM₁₀ concentration in 2010 was below the EU limit value of $40 \mu\text{g}/\text{m}^3$. But exceedences of WHO AQG of $20 \mu\text{g}/\text{m}^3$ for PM₁₀ and $10 \mu\text{g}/\text{m}^3$ for PM_{2.5} in many parts of Central, Eastern and South-Eastern Europe.

Trends in PM from 2000(1) - 2010



PM₁₀ mass at 24 sites:

Avg. decrease: **21%** $\pm 13\%$,
(0.33 $\mu\text{g}/\text{m}^3$ pr year)

54% of the sites show a significant decrease, non with significant increase.

PM_{2.5} mass at 13 sites:

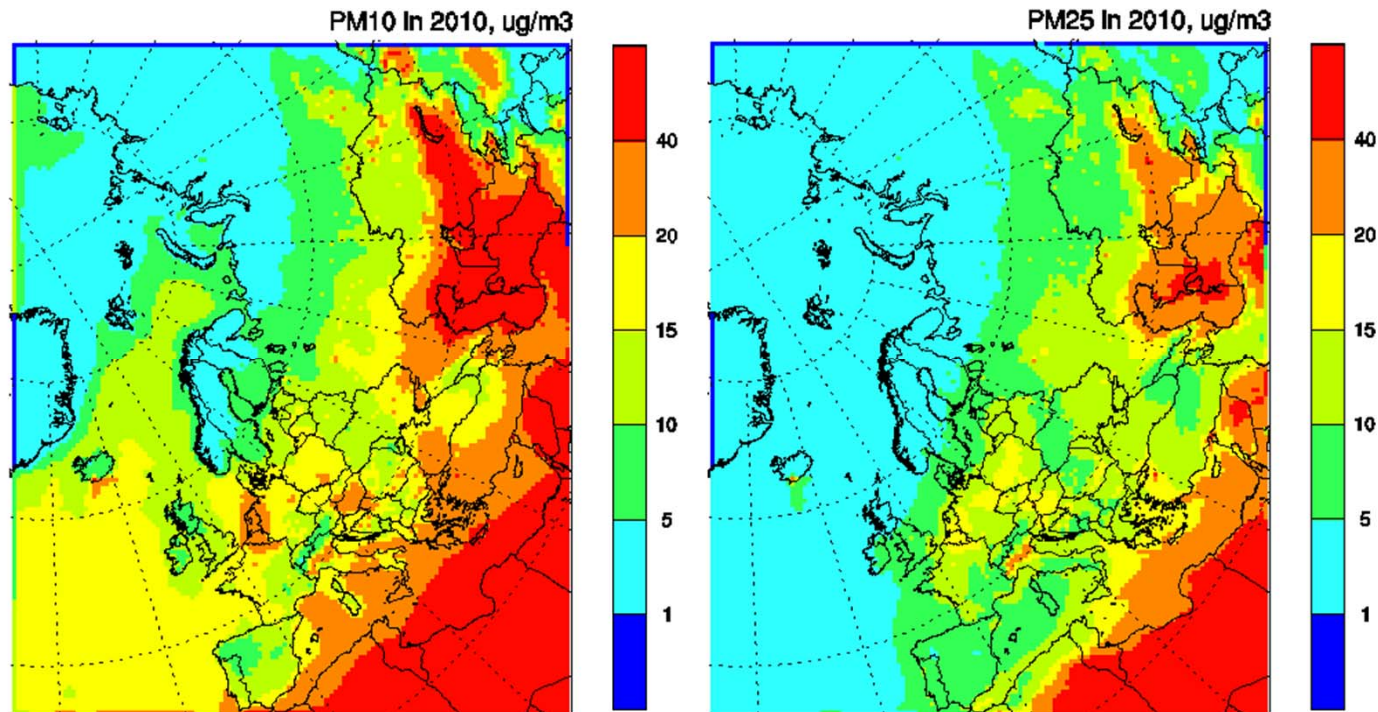
Avg. decrease: **27%** $\pm 14\%$,
(0.33 $\mu\text{g}/\text{m}^3$ pr year)

38% of the sites show a significant decrease, non with significant increase.

“Despite large inter-annual variations, there is a relatively clear general decrease in the observed mass concentration in Europe the last decade (*Tørseth et al., 2012; Barmpadimos et al., 2012*).”

Model results are in line with these observations

Combined model/measm. maps



2010 events which caused enhanced PM loads (compared to 2009):

- Favorable meteorological conditions for **dust generation** and transport caused increased PM in arid areas in south-eastern EECCA regions, Turkey and North Africa
- **Eyjafjallajökull volcano** eruption (mid-April to mid-May)
- Severe **forest fires** over central Russia during July-August.

Some regions showed lower level (i.e. Mediterranean, Norway.)

EMEP MSC-W model development

- implementation of secondary Organic Aerosols (SOA);
- implementation of re-suspended road dust
- implementation of explicit calculations of cloud water acidity (reduction of cloud pH increased sulphate formation);
- update of monthly temporal profiles of SO_x emissions;
- use of the more robust parameter “Soil Moisture Index” instead of “Soil moisture” from ECMWF-IFS data for windblown dust calculations;
- update of the rate of coarse NO_3^- formation; changing its Mass Median Diameter from $2.5 \mu\text{m}$ to $3 \mu\text{m}$ (so that 27% of coarse NO_3^- is assigned now to $\text{PM}_{2.5}$).

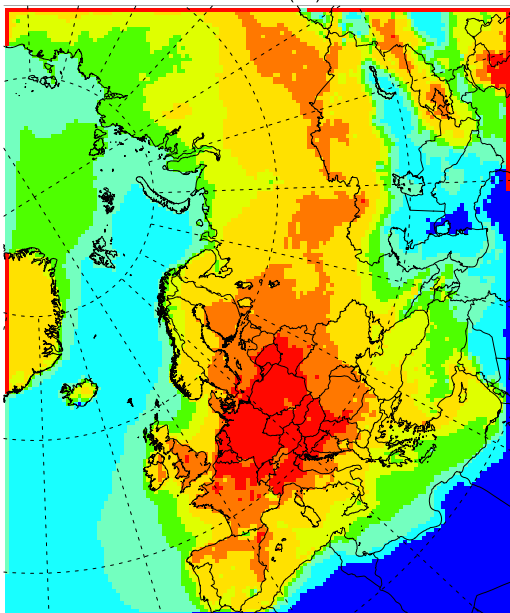


D. Simpson et al. Atmos. Chem. Phys., 12, 7825-7865, 2012

Chemical speciation of PM

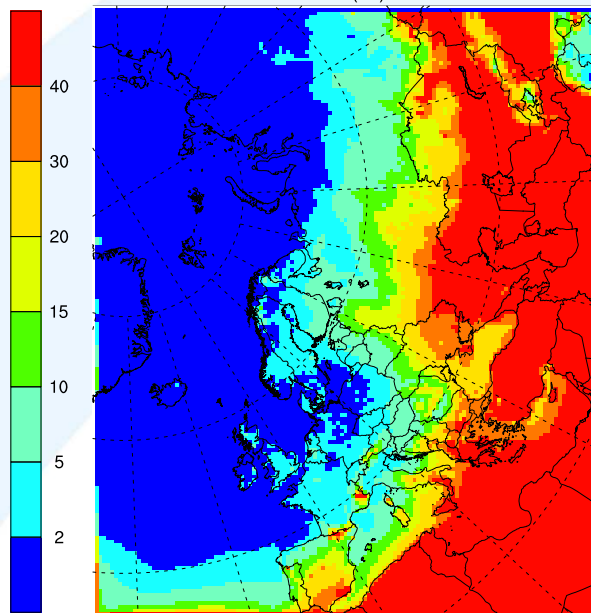
% SIA

Contribution(%) from SIA to PM10



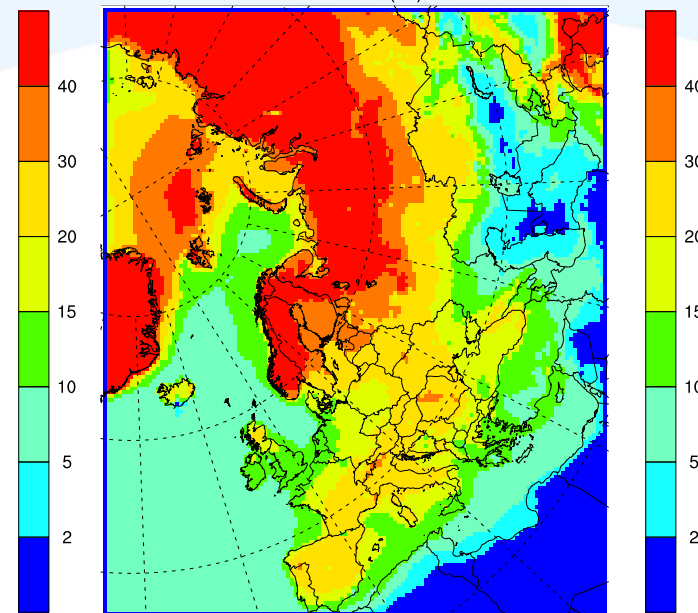
% Dust

Contribution(%) from DUST to PM10



% OA

Contribution(%) from OA to PM10



The development of the EMEP model to include all major species in the same model framework, makes it possible to present chemical speciation in a more coherent way



Improvements in model performance

As a result of recent endeavours at the MSC-W, model performance for PM has been significantly improved.

- PM_{10} and $PM_{2.5}$ are **underestimated 23% and 21%** respectively . Spatial correlation between calculations and measurements is 0.71 for PM_{10} and 0.79 for $PM_{2.5}$.
- negative bias for $PM_{2.5}$ is somewhat larger in winter compared to the summer-autumn period, probably due to underestimation of emissions from residential and commercial heating in winter.

SIA:

Underestimations :	8% for NO_3^- and	correlation: 0.80
	27% for SO_4^{2-} (20 % for ssc SO_4^{2-})	correlation: 0.86
	16% for NH_4^+	correlation: 0.74

Carbonaceous matter (note that there are also large uncertainties in the measurements)

OC 35-60% underestimations , expect ES1778 and NO02

EC both under- and overestimates the measured concentrations.

Dust: Too few measurements



emep

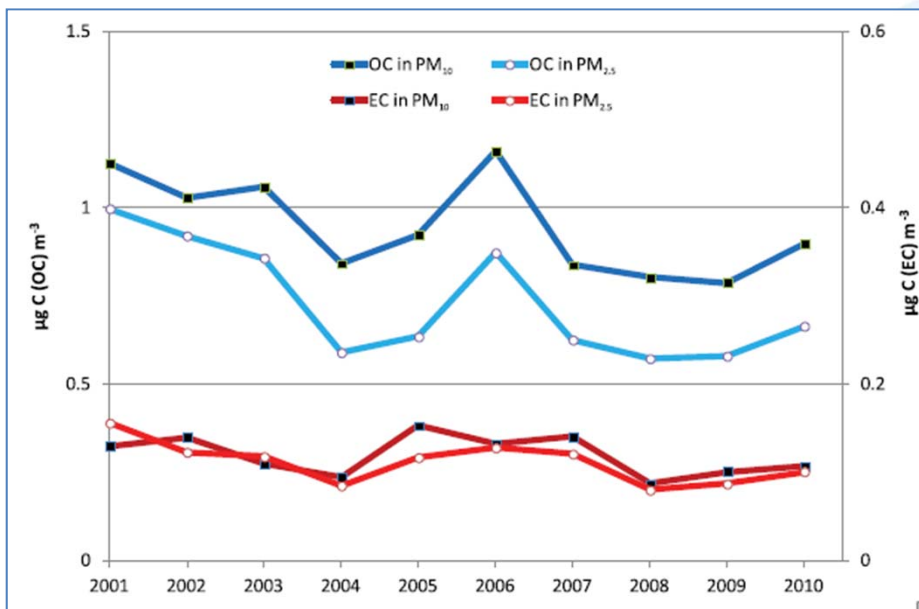
Measurements of carbonaceous matter (EC/OC)

Site (Country)	EC	OC	PM ₁	PM _{2.5}	PM ₁₀	Period
<u>Aspvreten</u> (Sweden)	X	X			X	2008, 2009, 2010
Birkenes (Norway)	X	X		X	X	2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010
Finokalia (Greece)	X	X			X	2008, 2009, 2010
Harwell (UK)	X	X			X	2009, 2010
Hurdal (Norway)	X	X		X	X	2010,
Ispra (Italy)	X	X		X		2002 ¹⁾ , 2003 ²⁾ , 2004 ²⁾ , 2005 ²⁾ , 2006, 2007, 2008, 2009, 2010
Košetice (Czech Rep.)	X	X		X		2009, 2010
Kårvatn (Norway)	X	X		X	X	2010
Melpitz (Germany)	X	X		X	X	2006, 2007, 2008, 2009, 2010
Montseny (Spain)	X	X		X	X	2007, 2008, 2009, 2010
Pay de Dome (France)	X	X		X		2008, 2009, 2010
<u>Vavihill</u> (Sweden)	X	X			X	2008, 2009, 2010

More sites and better quality. Harmonised measurements (EUSAAR-2 protocol) and sampling time and sampling frequency; has improved.

Trends , EC/OC

NO01



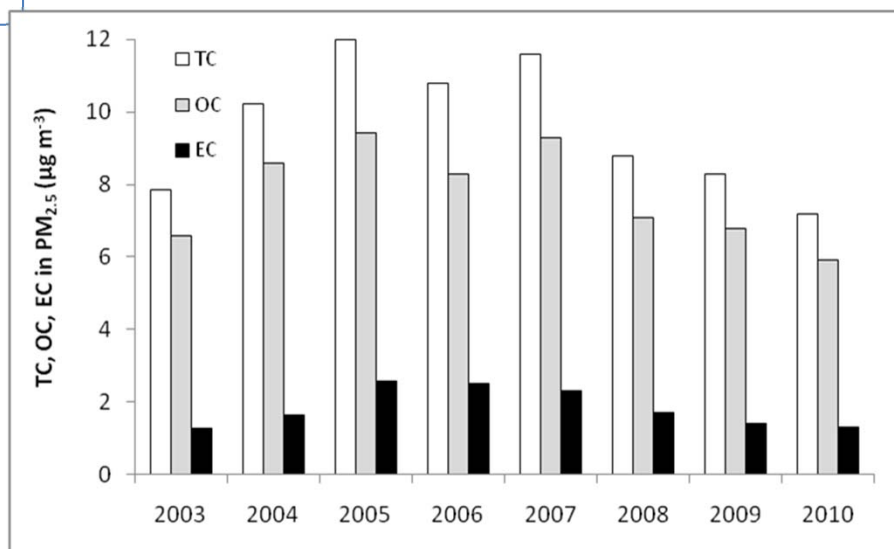
NO01:

- No significant trend in the annual mean concentration of OC and
- inter-annual variability

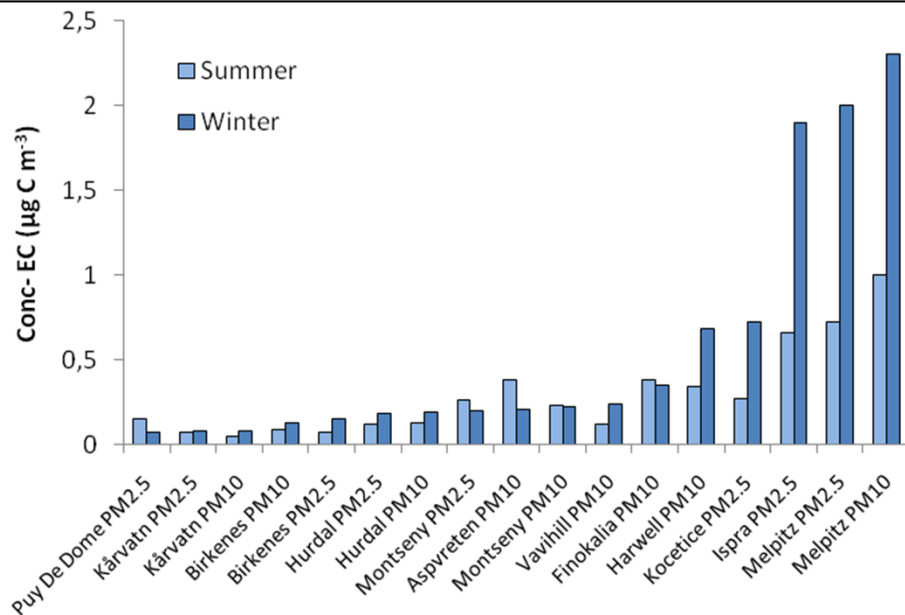
IT04

IT04

Since 2005, the annual mean EC and OC concentration has decreased by a substantial 50% and 40% respectively



Regional and seasonal variations

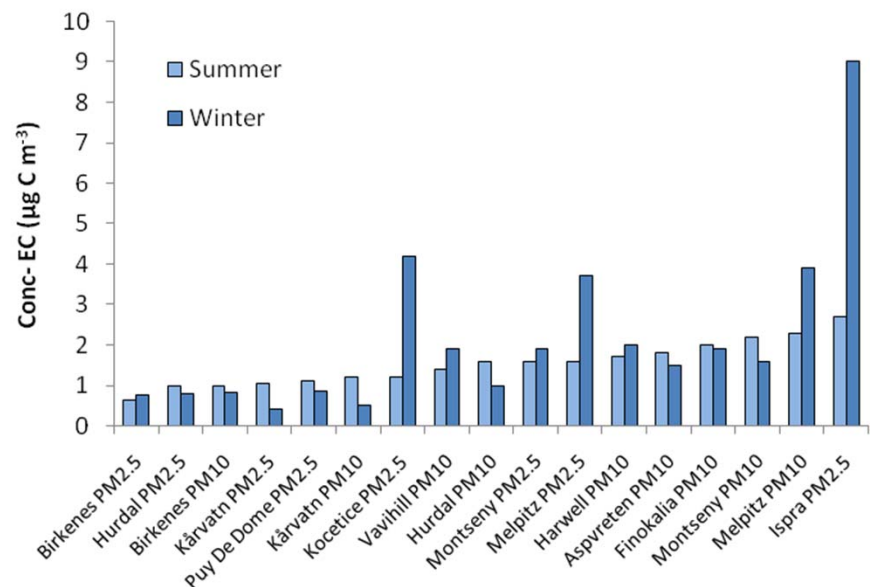


EC

- lowest level in Scandinavia
- highest levels at observed at Košetice and Melpitz in Eastern Europe, Harwell in the UK, and Ispra in northern Italy
- The EC level increased by a factor of two or more at the four sites with highest mean
- EC is associated mainly with fine particles, resulting from incomplete combustion of fossil fuels and biomass. I

OC

- lowest level in Scandinavia
- highest at Ispra in northern Italy, elevated at levels at Košetice, Melpitz
- The OC level increased substantially at the the three sites with highest mean due to increased emissions (biomass burning) and meteorological conditions preventing dispersion
- Increase level in summer at some sites (SOA and PBAP)



Modelling of carbonecous matter

- The volatility basis set (VBS) approach for secondary organic aerosol (SOA) has been added to the available defaults of the EMEP chemical code
- Modelling of organic aerosol is subject to much larger problems than those of many other pollutants
- One of the major uncertainties to build or evaluate reliable SOA models is the current emission estimates:
- **Emission inventories for especially biogenic volatile organic compounds (BVOC) and primary organic aerosols (POA), including residential wood-combustion (RWC) should be priority areas.**

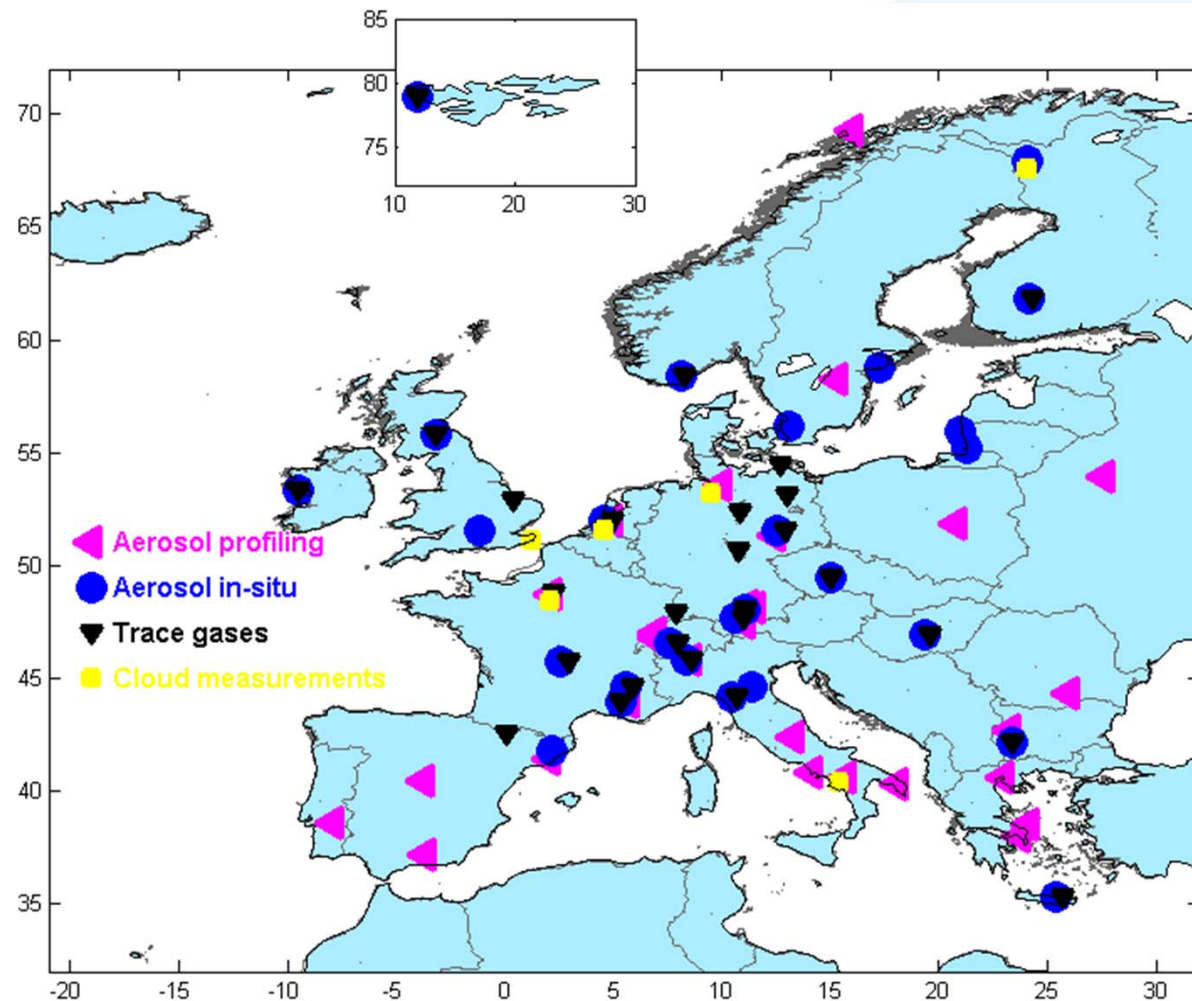


Bergström, et al. Atmos. Chem. Phys. Discuss., 12, 5425-5485, 2012

Simpson et al. Atmos. Chem. Phys., 12, 7825-7865, 2012

EMEP and the EU project ACTRIS -

Aerosols, Clouds, and Trace gases Research InfraStructure Network: a Collaboration for Mutual Benefit

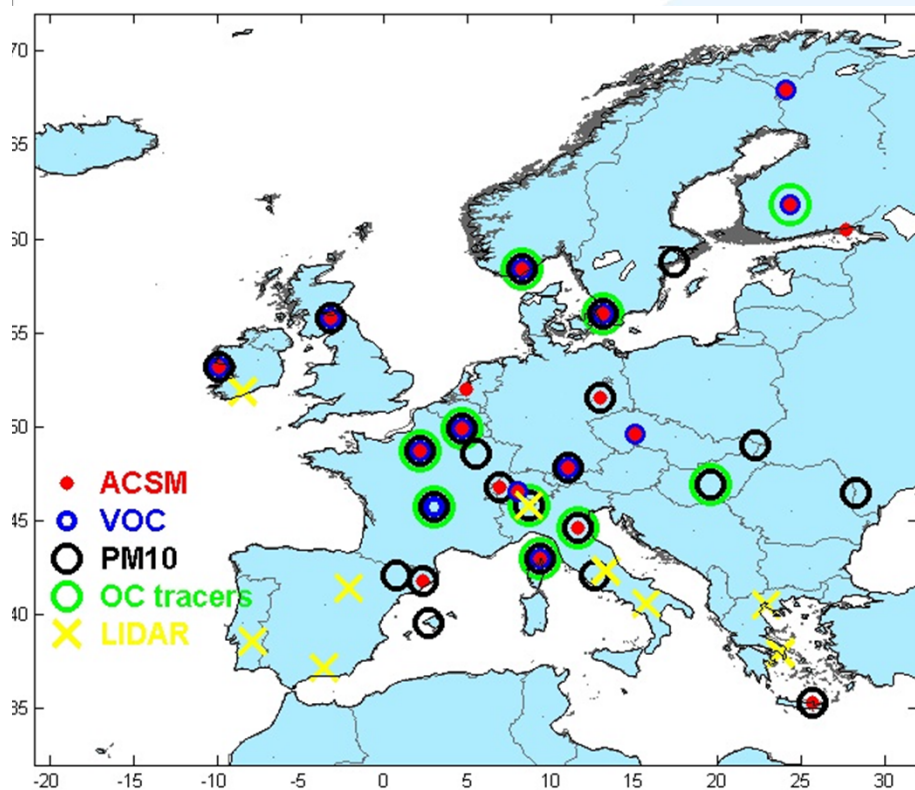


Integrating European ground-based stations equipped with advanced atmospheric probing instrumentation for **aerosols, clouds and short-lived gas-phase species.**

secure a continuation of what was achieved in EUSAAR. ACTRIS is contributing to further strengthening and developing EMEP (and Earlinet and Cloudnet) and to the quality of their measurements.

EMEP/ACTRIS Intensive Measurement periods in 2012 and 2013.

Close cooperation with the ChArMEx and PEGASOS projects

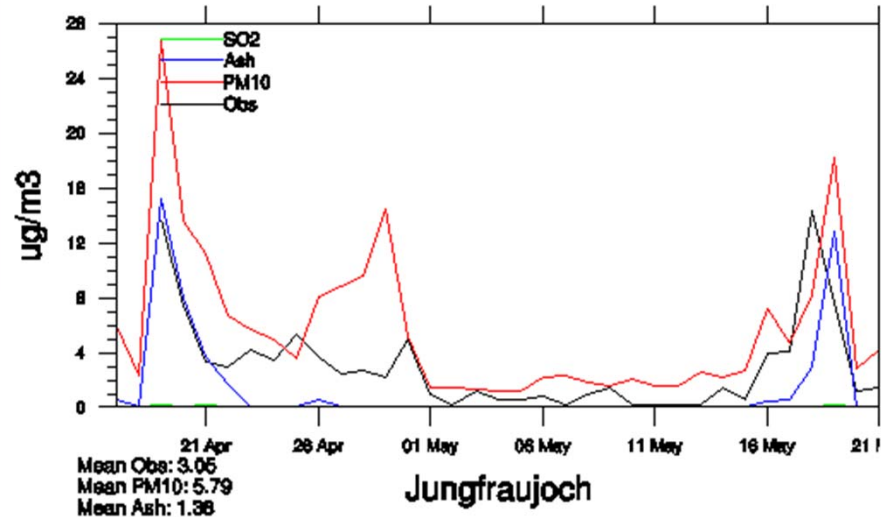
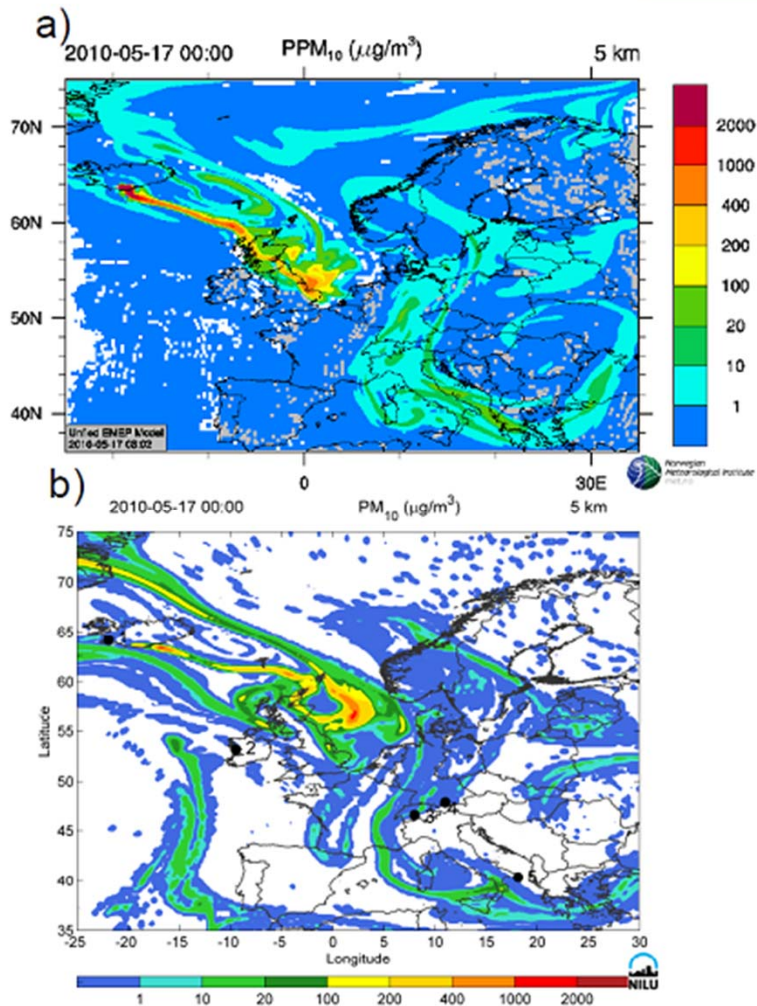


A large suit of measurements with extended measurements of aerosols and its precursors are conducted:

- ✓ PM₁₀ speciation including **mineral dust**
- ✓ Organic **tracers**
- ✓ Carbonate (**CO₃**)
- ✓ One year measurements with the Aerodyne™ Aerosol Chemical Speciation Monitors (**ACSM** (+ absorption measurements for source apportionment of **BC**)
- ✓ Intensive measurements of **VOC**
- ✓ Vertical profiles (**lidars**)

Monitoring and modelling volcanic aerosols from the Eyjafjallajökull eruption

Modelled PM₁₀ on the 17 May
a) EMEP/MSC-W b) FLEXPART



The models were able to reproduce the occurrence of most of pollution episodes. However, the levels and timing may be inaccurate and some modelled volcanic ash episodes are not found in observational data, or oppositely.

Good quality of meteorological input estimates of volcanic emissions are crucial

Main achievements

- ❖ Extensive improvement of the EMEP MSC-W model
- ❖ Large effort been put into publishing EMEP work in the EMEP ACP Special issue
- ❖ Huge involvements by Parties, Centers and external partners (projects) in organizing the EMEP intensive measurement period (summer 2012)

Work plan, particulate matter

- ❖ EMEP/ACTRIS **intensive measurements** (IMP) jan/febr 2013
 - ✓ Mineral dust from EMEP IMP. Support for WGE
 - ✓ Carbonaceous matter (EC/OC, carbonate, tracers, OM from ACSM etc)
- ❖ Source apportionment analysis. EMEP intensive data from 2008-2009
 - ✓ the **EURODELTA3** follow-up modelling exercise
- ❖ **Nitrogen chemistry** (coarse nitrate on sea salt and dust; ammonia compensation point)
- ❖ Support further developments in the **EECCA** region
 - ✓ EC/OC + levoglucosan for one year at four EECCA sites (KZ,MD,GE,AR)
- ❖ Extended use of the EMEP measurements of aerosol optical- and physical properties, in combination with the EMEP model
 - ✓ Look more closely at concurrent **EC and BC** measurements at several EMEP sites