The Abdus Salam
International Centre for Theoretical Physics

The International Union of Geodesy and Geophysics

United Nations
Educational, Scientific and
Cultural Organization

IAEA
International Atomic Energy Agency

2339-4

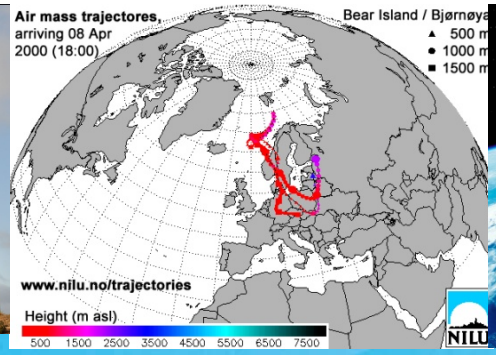
Workshop on Atmospheric Deposition: Processesand Environmental Impacts

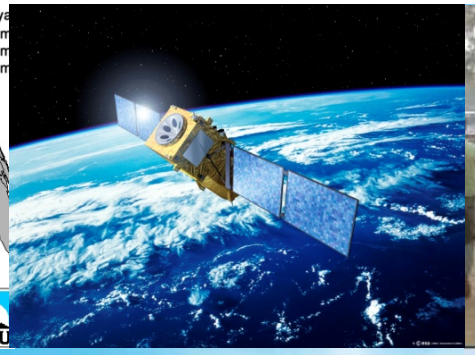
21 - 25 May 2012

Monitoring of atmospheric composition and trends

Wenche Aas
NILU Norwegian Institute for Air Research
Norway

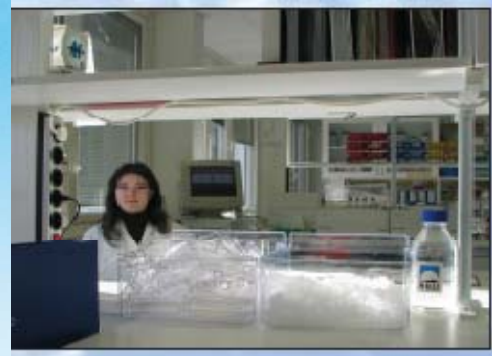
Strada Costiera 11, 34151 Trieste, Italy - Tel.+39 040 2240 111; Fax +39 040 224 163 - sci_info@ictp.it





Monitoring of atmospheric composition and trends.

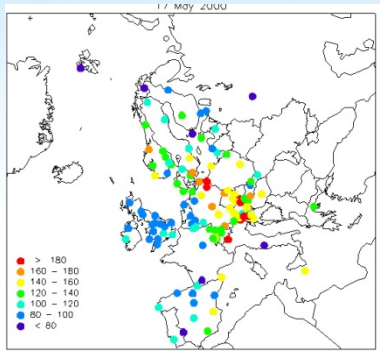
main focus on Europe, + a bit on Asia

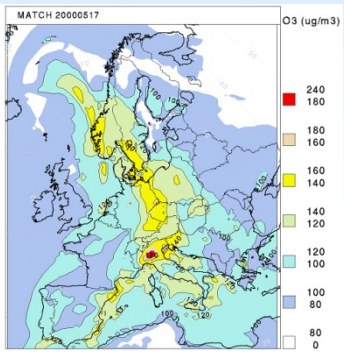


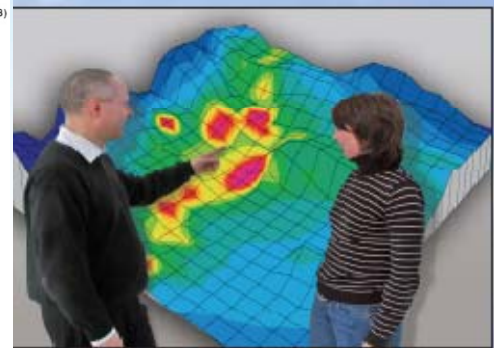
Trieste , 22 May 2012

Wenche Aas

NILU - Norwegian Institute for Air Research







Outline

- Why do monitoring?
  - ✓ Effect (policy) driven motivation for monitoring, which may change over time –new and old problems
  - ✓ Measurements for model evaluation and development
  - ✓ Research needs
  - ✓ Local or national engagment/involvement/avereness
- What to measure?
  - ✓ monitoring obligations, compliance with protocols etc
  - ✓ Research needs
- How and where ?
  - ✓ Quality assurance
  - ✓ Representativity
  - ✓ Networks

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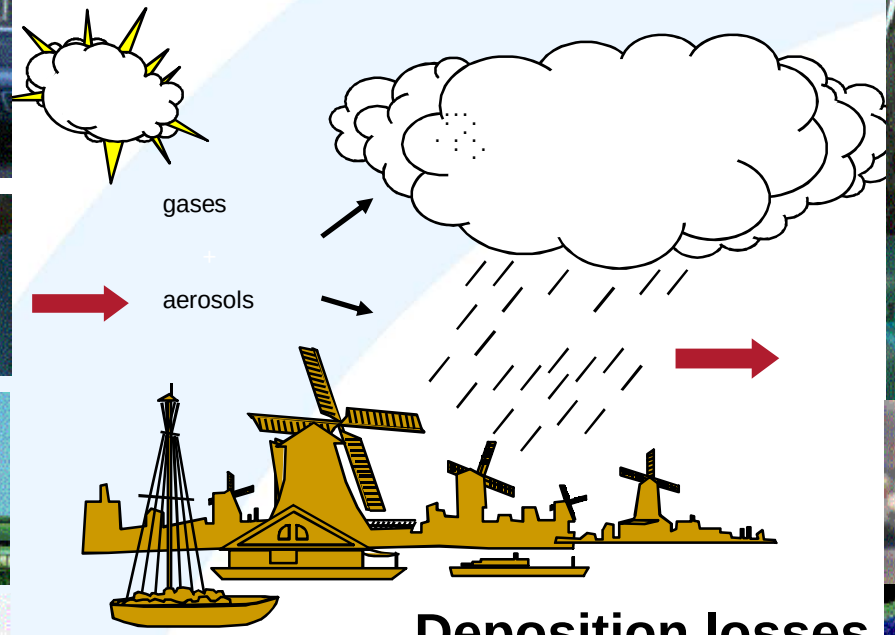
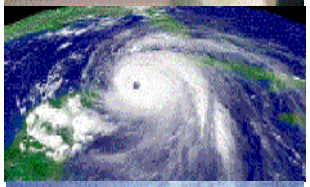
Air pollution and impacts

Atmospheric transport and chemistry



Deposition losses

Mobile, industrial and non-point sources



Receptors

Cultural heritage

Ecosystems

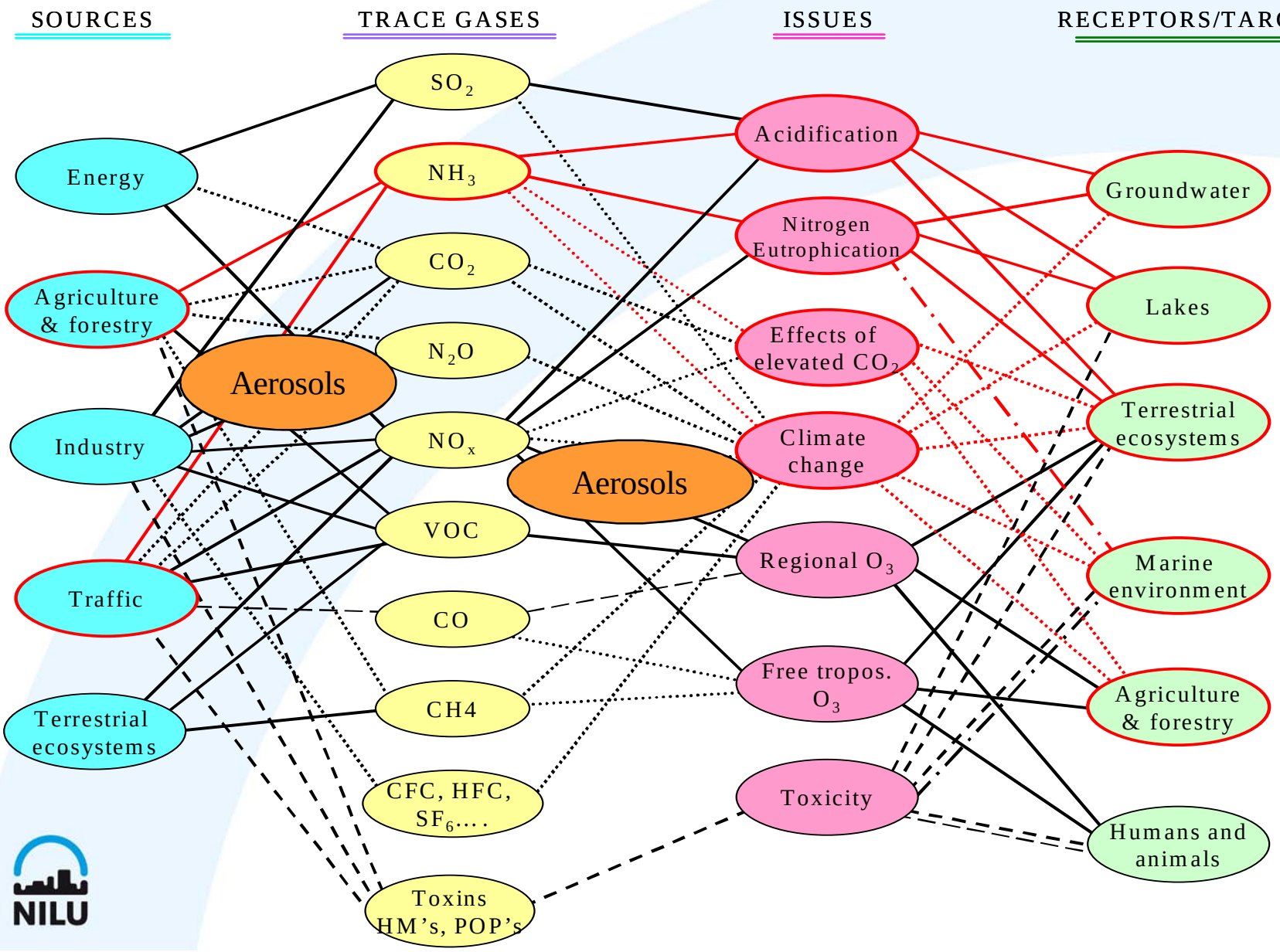
Crops

Humans/animals

Climate

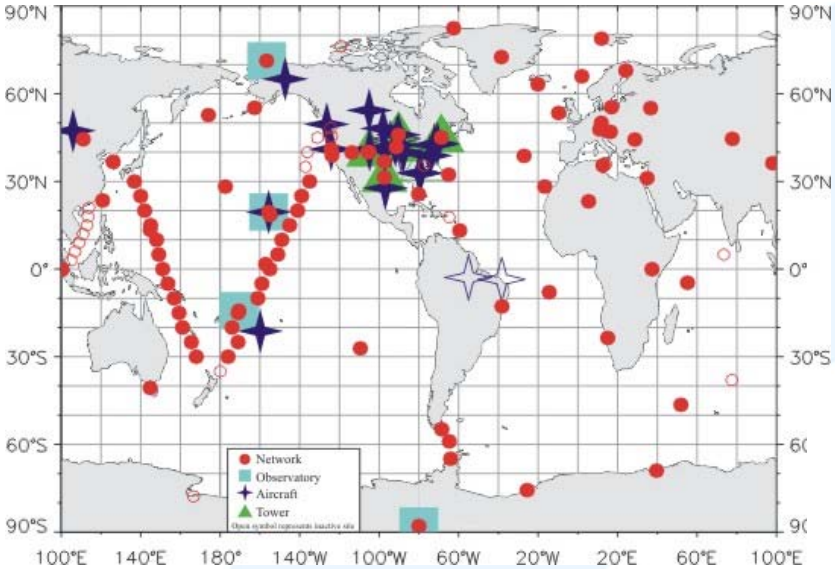
Estuaries

Air pollution and impacts

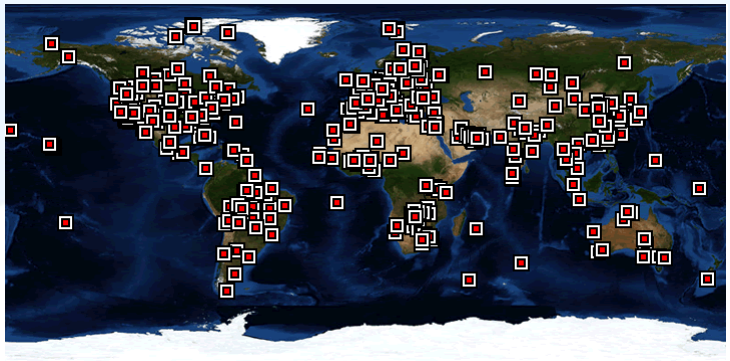


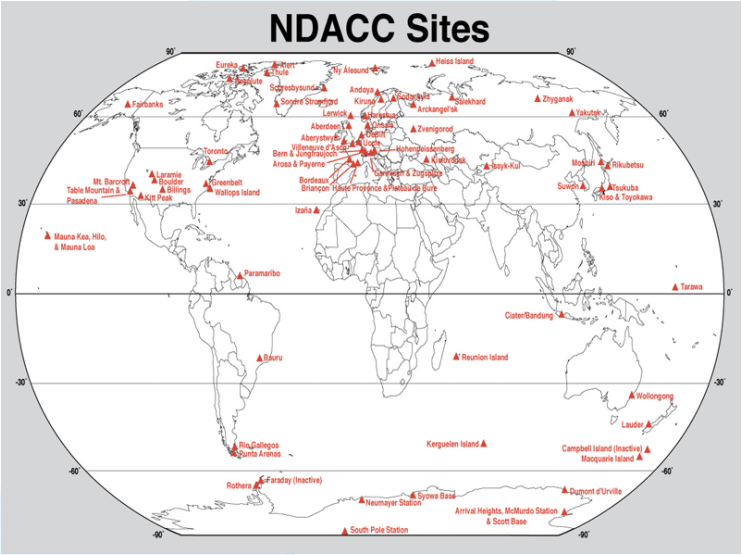
Some global programmes

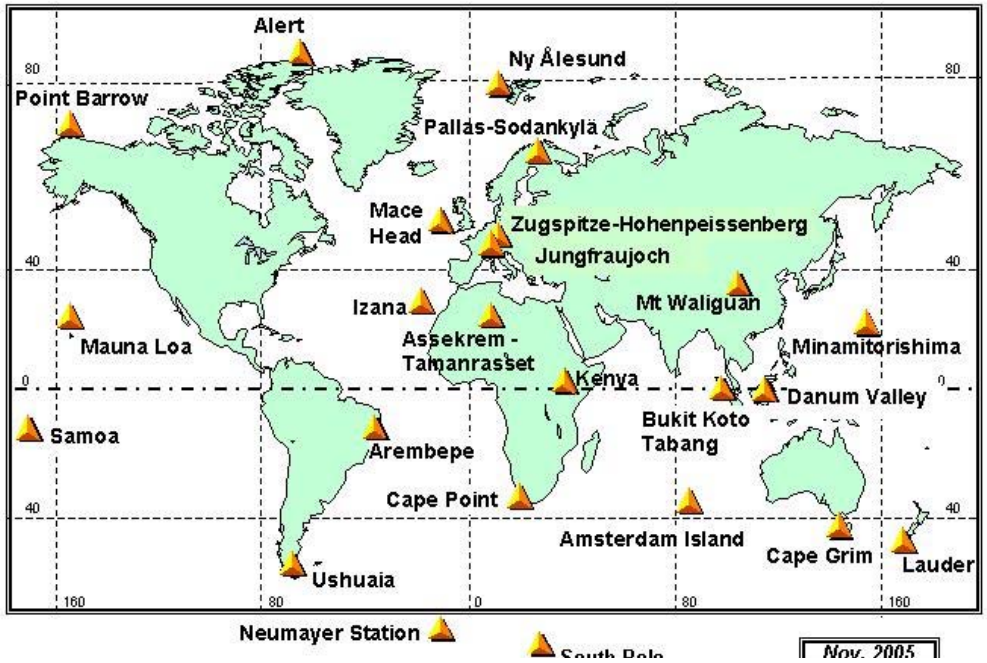
NOAA GMD Carbon cycle



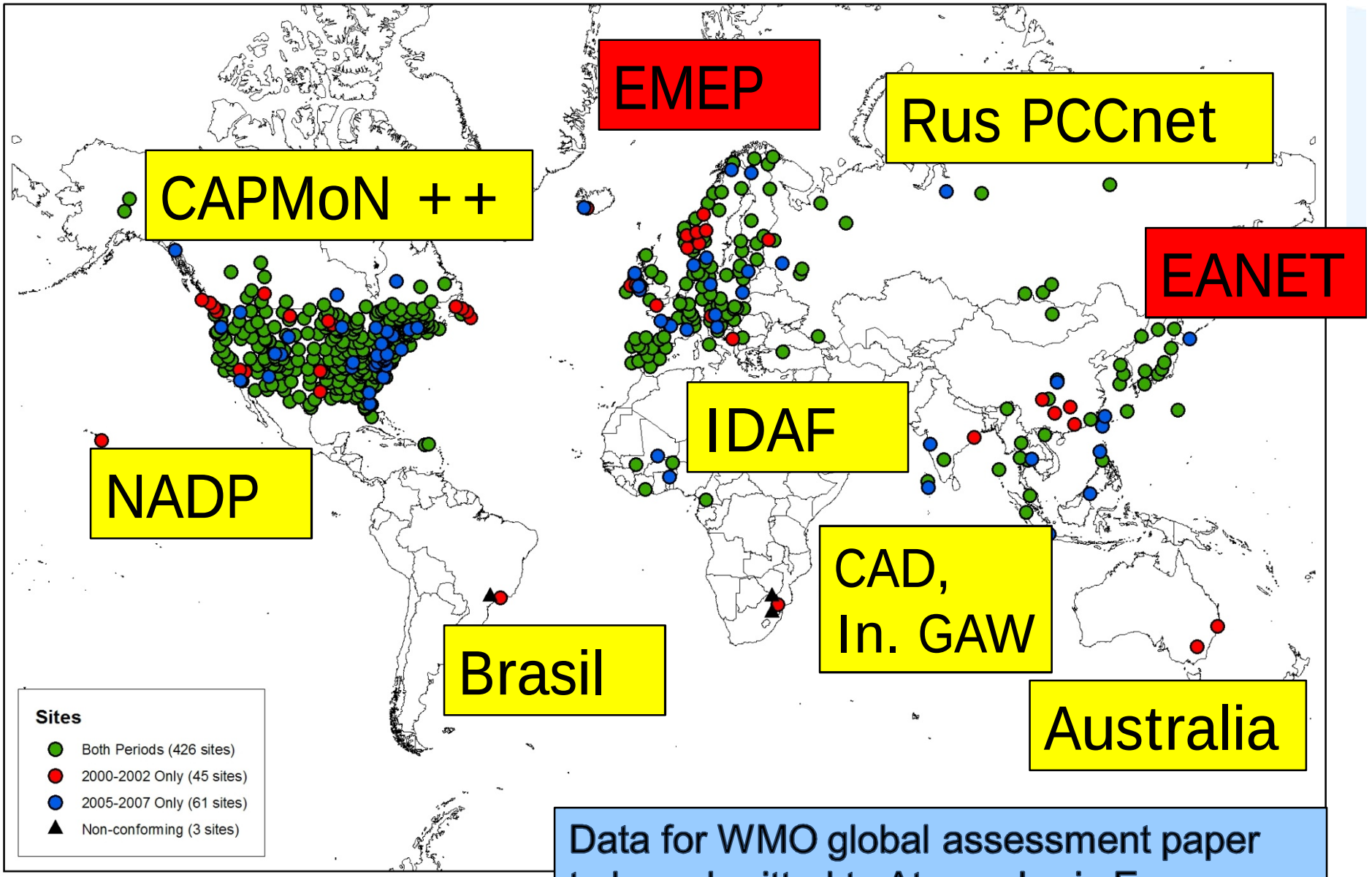
AERONET







WMO Precipitation Monitoring Sites (2000-2007)

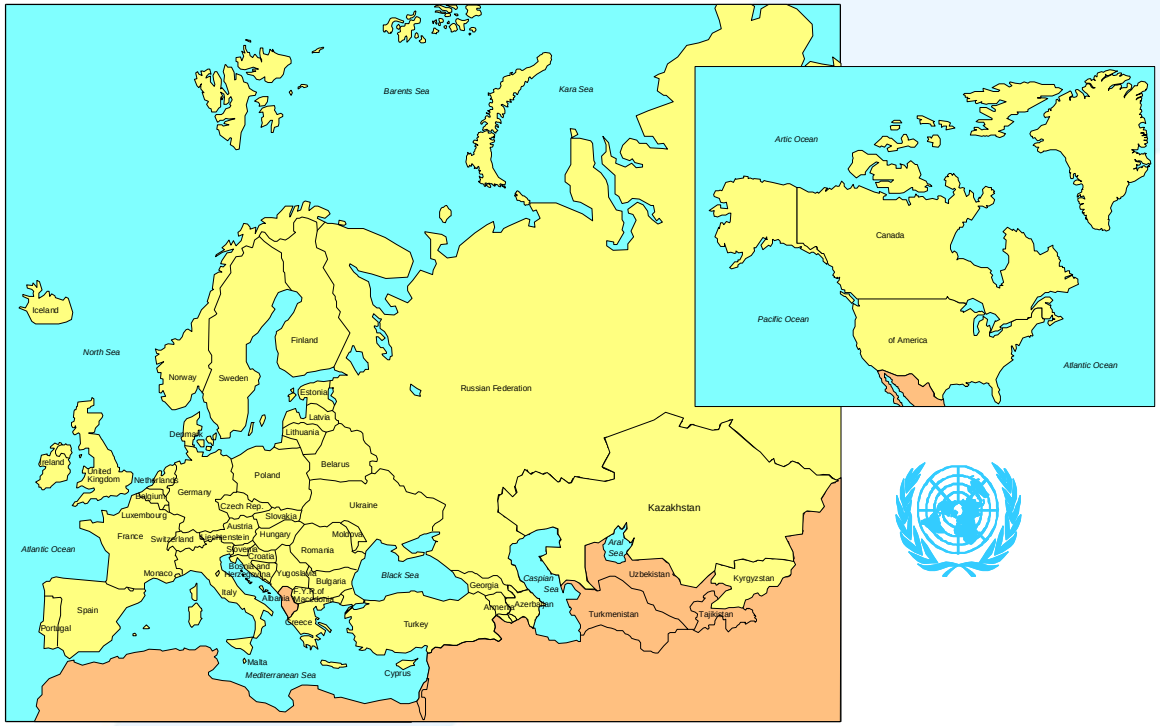


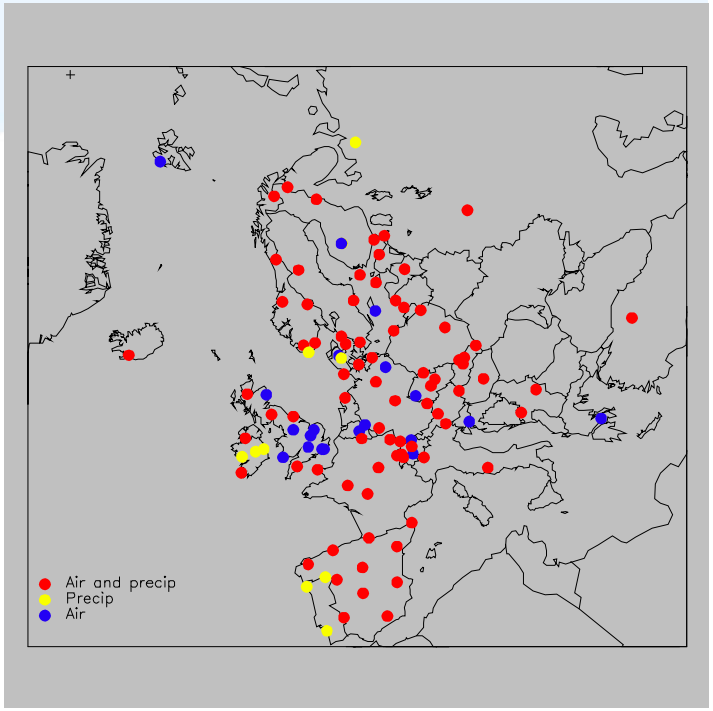
Data for WMO global assessment paper
to be submitted to Atmospheric Env
Not to be distributed

UN-ECE Convention on Long-Range Transboundary Air Pollution (52 Parties)

- **8 Specific protocols, where the first is**

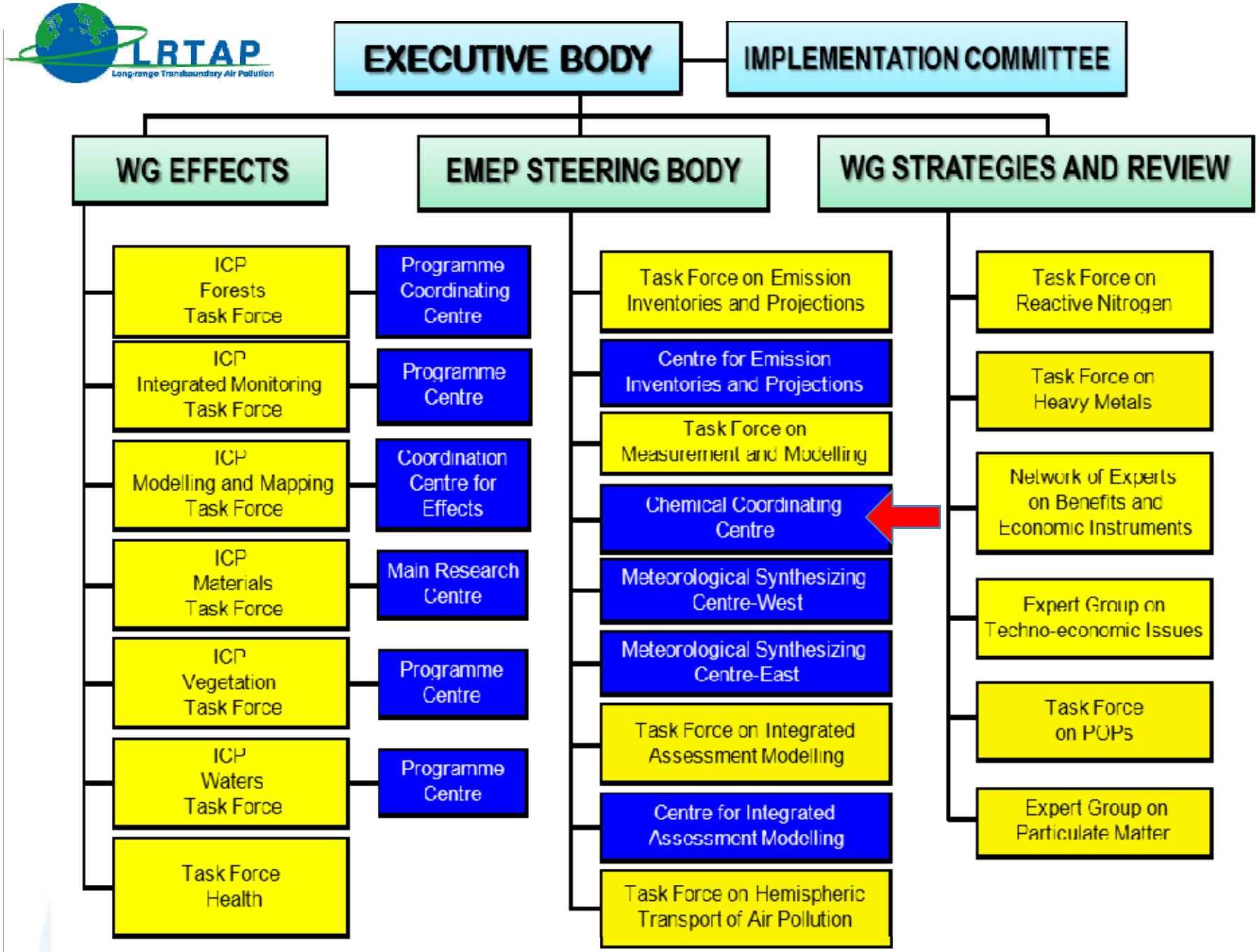
European Monitoring and Evaluation Programme (EMEP) (42 Parties)





The EMEP vision;

To be the main science based and policy-driven instrument for international cooperation in atmospheric monitoring and modelling activities, emission inventories and projections, and integrated assessment to help solve transboundary air pollution problems in Europe


LRTAP
Long-range Transboundary Air Pollution
EXECUTIVE BODY
IMPLEMENTATION COMMITTEE
WG EFFECTS
EMEP STEERING BODY
WG STRATEGIES AND REVIEW
ICP Forests Task Force
ICP Integrated Monitoring Task Force
ICP Modelling and Mapping Task Force
ICP Materials Task Force
ICP Vegetation Task Force
ICP Waters Task Force
Task Force Health
Programme Coordinating Centre
Programme Centre
Coordination Centre for Effects
Main Research Centre
Programme Centre
Programme Centre
Task Force on Emission Inventories and Projections
Centre for Emission Inventories and Projections
Task Force on Measurement and Modelling
Chemical Coordinating Centre
Meteorological Synthesizing Centre-West
Meteorological Synthesizing Centre-East
Task Force on Integrated Assessment Modelling
Centre for Integrated Assessment Modelling
Task Force on Hemispheric Transport of Air Pollution
Task Force on Reactive Nitrogen
Task Force on Heavy Metals
Network of Experts on Benefits and Economic Instruments
Expert Group on Techno-economic Issues
Task Force on POPs
Expert Group on Particulate Matter

Protocols to the Convention

- 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone; PM to be included
- 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs)
- 1998 Aarhus Protocol on Heavy Metals

- 1994 Oslo Protocol on Sulphur
- 1991 Geneva Protocol on Volatile Organic Compounds
- 1988 Sofia Protocol on Nitrogen Oxides
- 1985 Helsinki Protocol on Sulphur

- 1984 Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP); 43 Parties.

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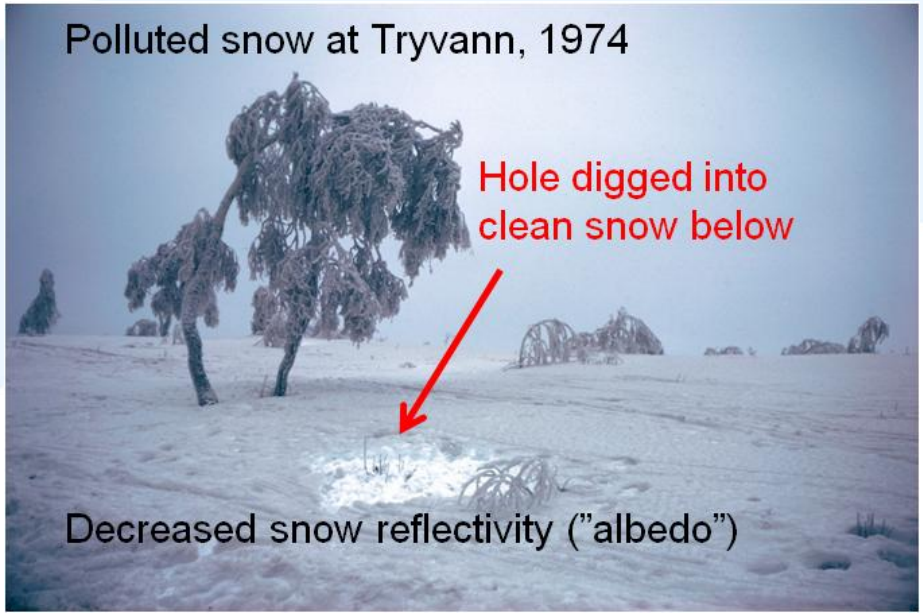
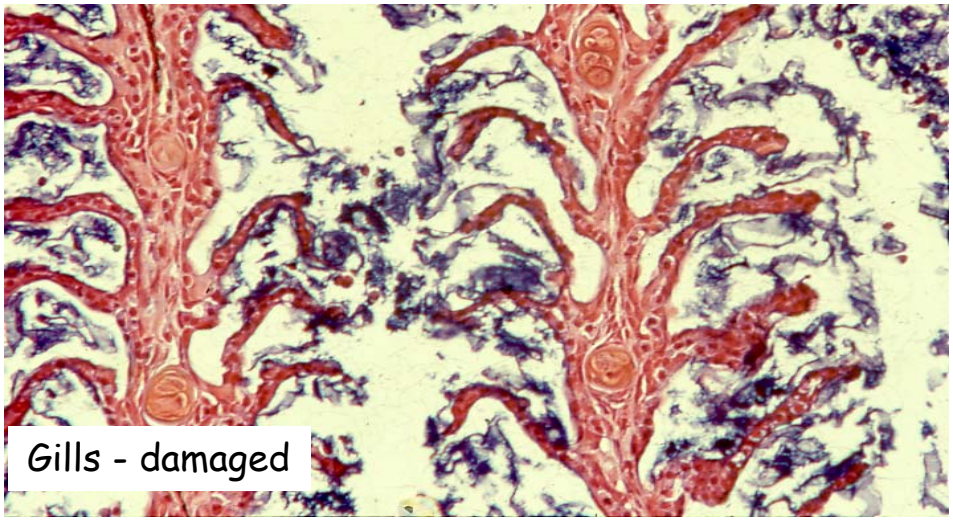
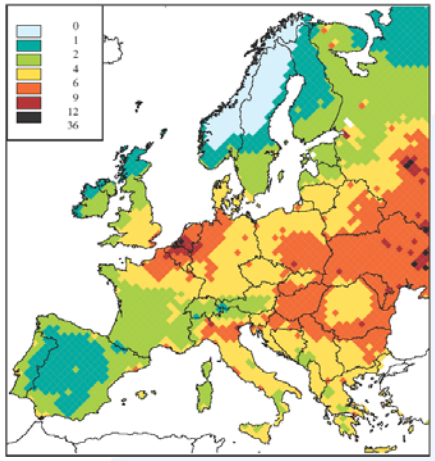
Long Range Transport of Air Pollutants



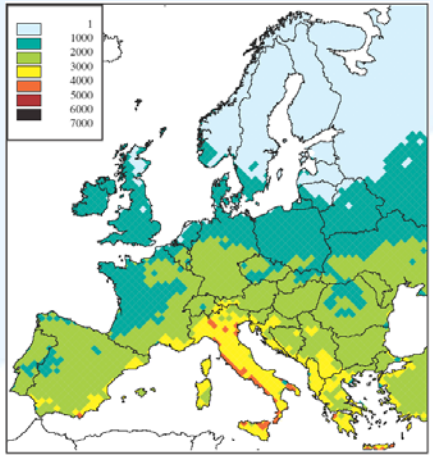


Environmental problems in 2020

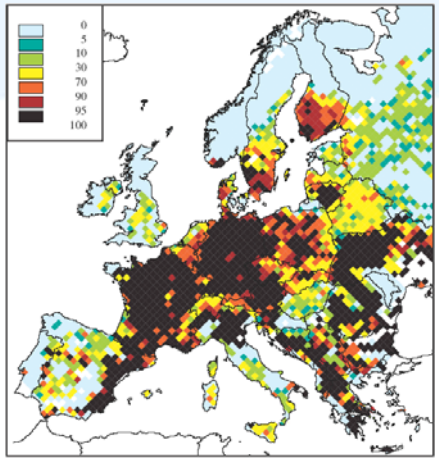
Light blue = no risk



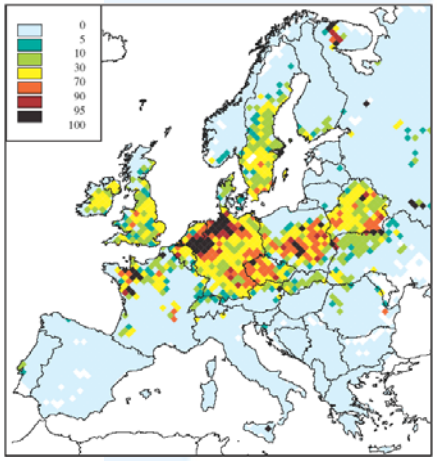
Health - PM



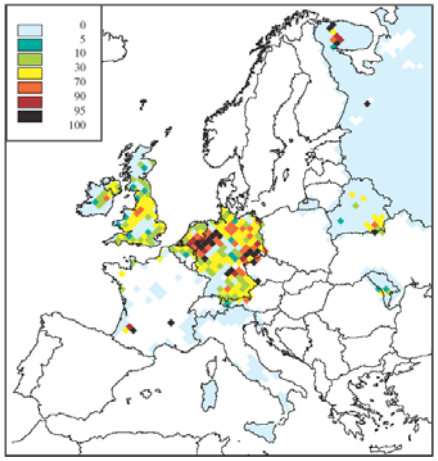
Health+vegetation - ozone



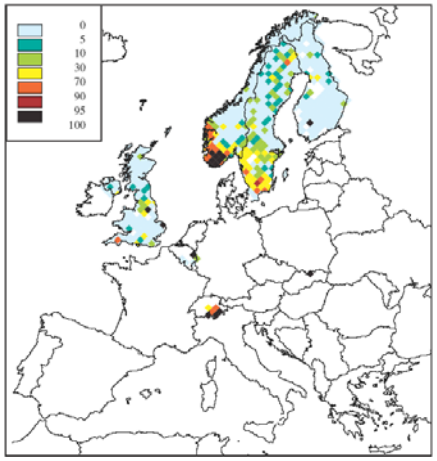
Vegetation – N dep.



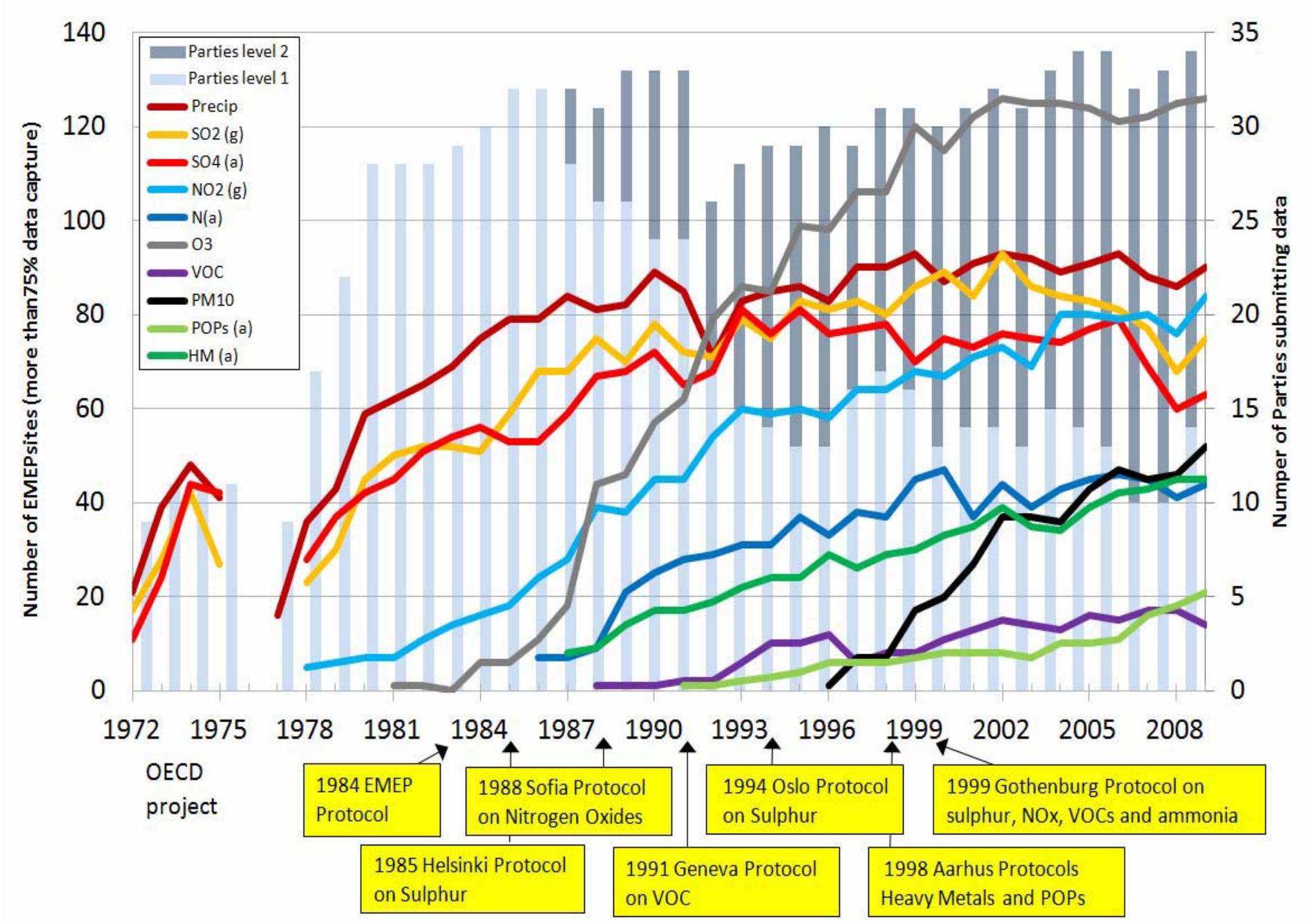
Forests – acid dep.



Semi-natural – acid dep.



Freshwater – acid dep.


Parties level 2
Parties level 1
Precip
SO2 (g)
SO4 (a)
NO2 (g)
N(a)
O3
VOC
PM10
POPs (a)
HM (a)
Number of EMEPsites (more than75% data capture)
Numper of Parties submitting data
140
120
100
80
60
40
20
0
35
30
25
20
15
10
5
0
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
OECD project
1984 EMEP Protocol
1988 Sofia Protocol on Nitrogen Oxides
1994 Oslo Protocol on Sulphur
1999 Gothenburg Protocol on sulphur, NOx, VOCs and ammonia
1985 Helsinki Protocol on Sulphur
1991 Geneva Protocol on VOC
1998 Aarhus Protocols Heavy Metals and POPs

Atmos. Chem. Phys. Discuss., 12, 1733–1820, 2012
www.atmos-chem-phys-discuss.net/12/1733/2012/
doi:10.5194/acpd-12-1733-2012

Atmospheric Chemistry and Physics Discussions

Introduction to the European Monitoring and Evaluation Programme (EMEP) and observed atmospheric composition change during 1972–2009

K. Tørseth, W. Aas, K. Breivik, A. M. Fjæraa, M. Fiebig, A. G. Hjellbrekke, C. Lund Myhre, S. Solberg, and K. E. Yttri

NILU – Norwegian Institute for Air Research, P.O. Box 100, 2027 Kjeller, Norway

Received: 31 December 2011 – Accepted: 9 January 2012 – Published: 19 January 2012

Correspondence to: K. Tørseth (kt@nilu.no)

Published by Copernicus Publications on behalf of the European Geosciences Union.

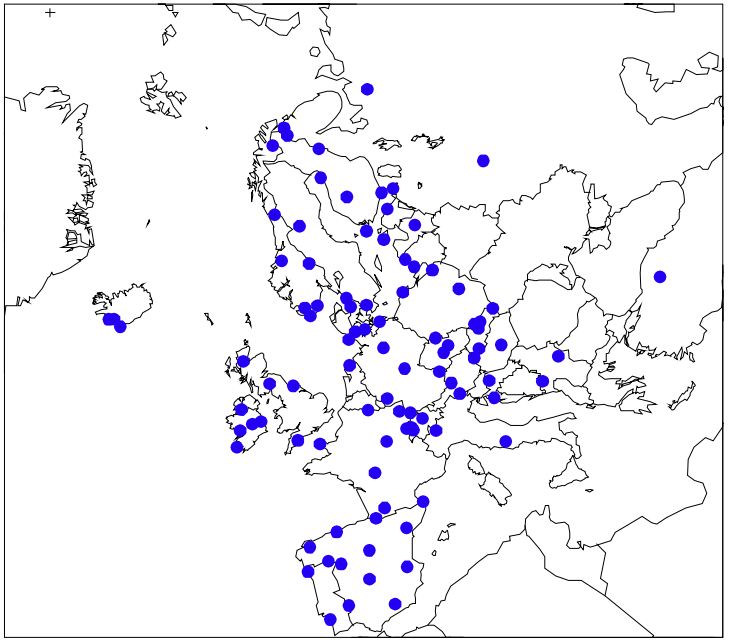
Accepted and in press in ACP

Monitoring programme:

Level 1

- Main ions in precipitation and in air
- heavy metals in precipitations
- ozone
- gas particle nitrogen ratios (low cost)
- PM_{10} and $PM_{2.5}$ mass
- meteorology

at ca 125 sites

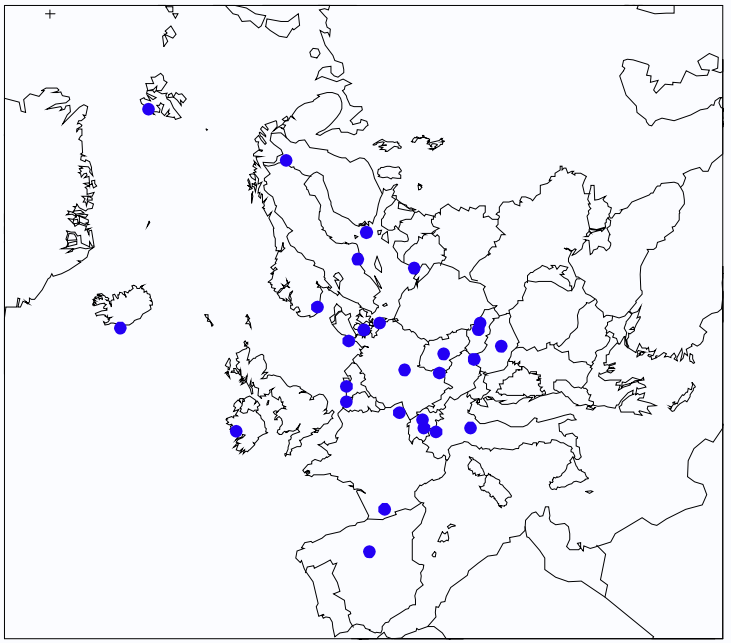


Level 2, supersite (joint EMEP/GAW)

- PM composition (EC/OC, mineral dust)
- Aerosol physical and optical properties
- CH_4
- Tracers (CO and halocarbons)
- POPs
- Heavy metals in air and aerosols
- VOC

+ all level 1 activities

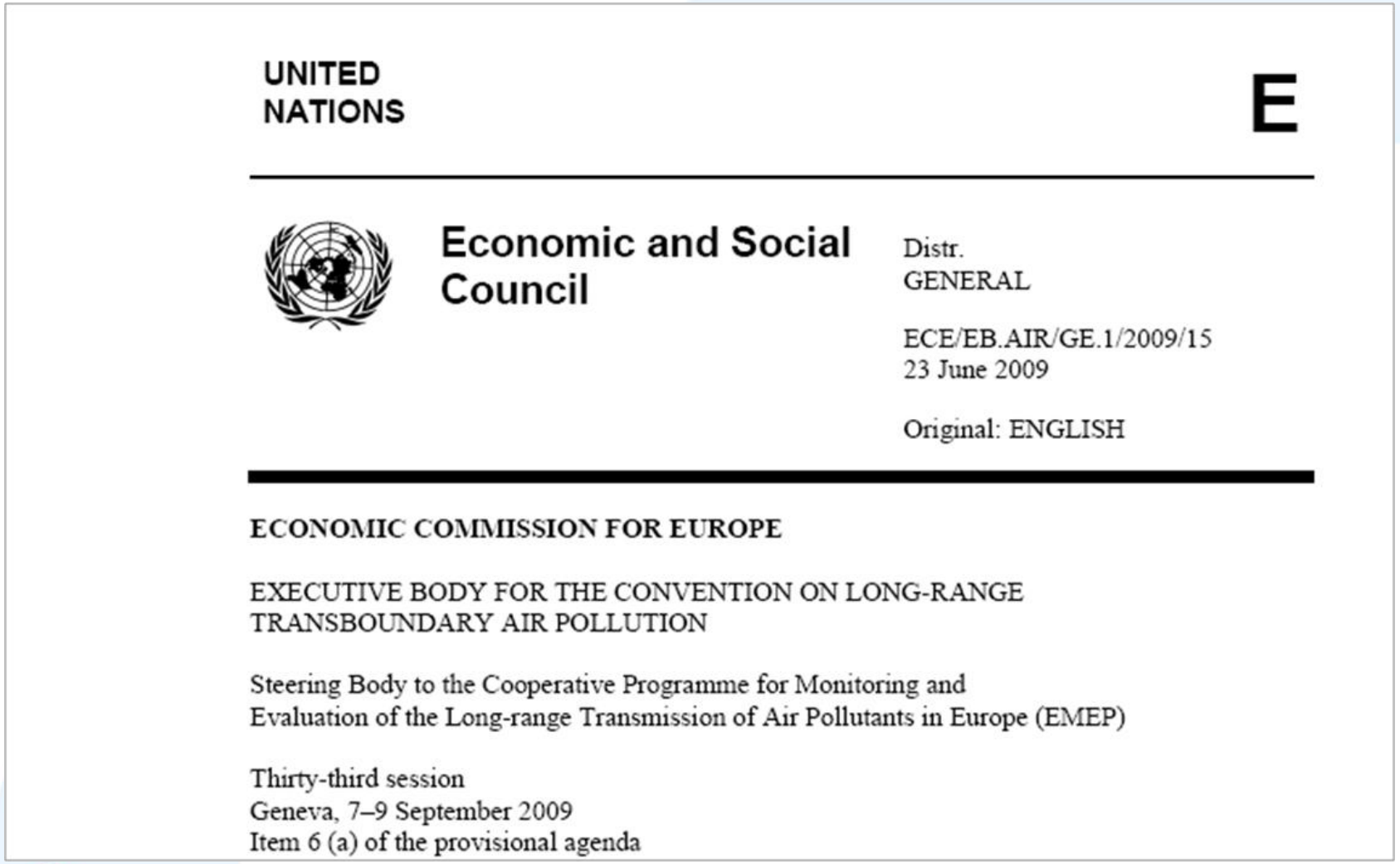
20-30 sites



Both levels are mandatory by all Parties

EMEP Monitoring strategy, 2010-2019

http://www.unece.org/env/documents/2009/EB/ge1/ece.eb.air.ge.1.2009.15.e.pdf



UNITED NATIONS

E

Economic and Social Council

Distr.
GENERAL

ECE/EB.AIR/GE.1/2009/15
23 June 2009

Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

EXECUTIVE BODY FOR THE CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)

Thirty-third session
Geneva, 7–9 September 2009
Item 6 (a) of the provisional agenda

NILU

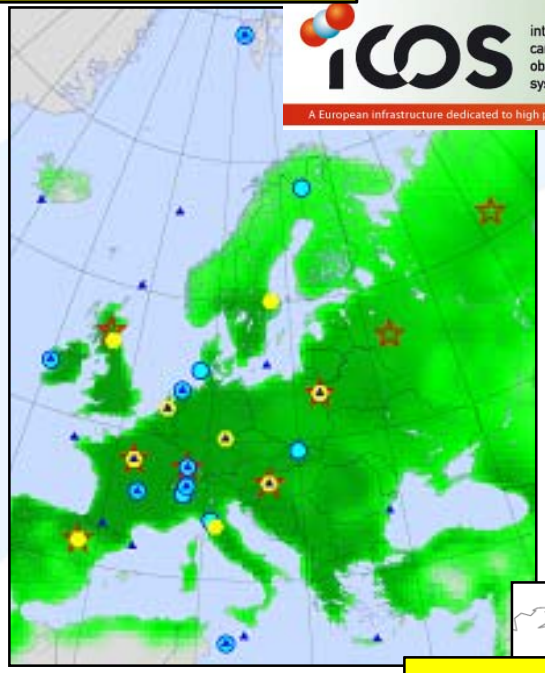
EU research infrastructures and projects supporting EMEP level 2 and 3

EUSAAR
European Supersites for Atmospheric Aerosol Research

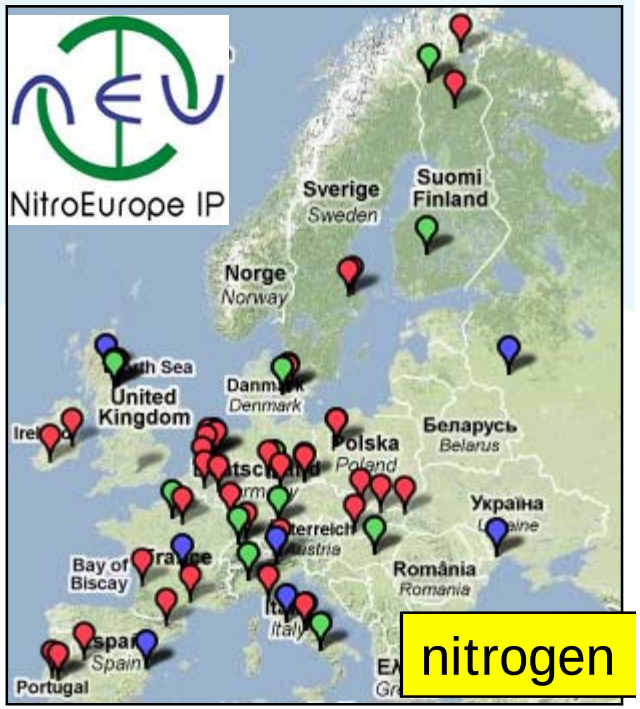
Aerosol properties

CO, CH4, CO2

ICOS
integrated carbon observation system
A European infrastructure dedicated to high precision mo

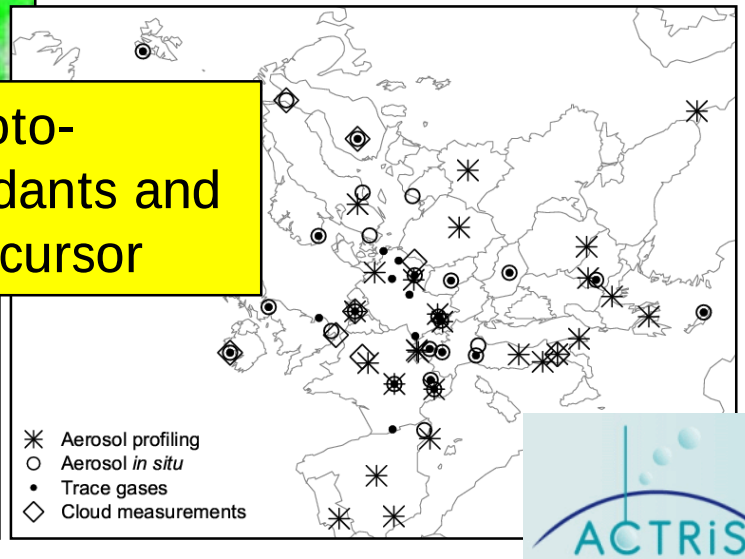


NitroEurope IP



nitrogen

photo-oxidants and precursor



Non CO_2 greenhouse gases

InGOS

Mercury

GMOS
Global Mercury Observation System

ACTRiS

EANET, Acid Deposition Monitoring Network in East Asia (from 2001)

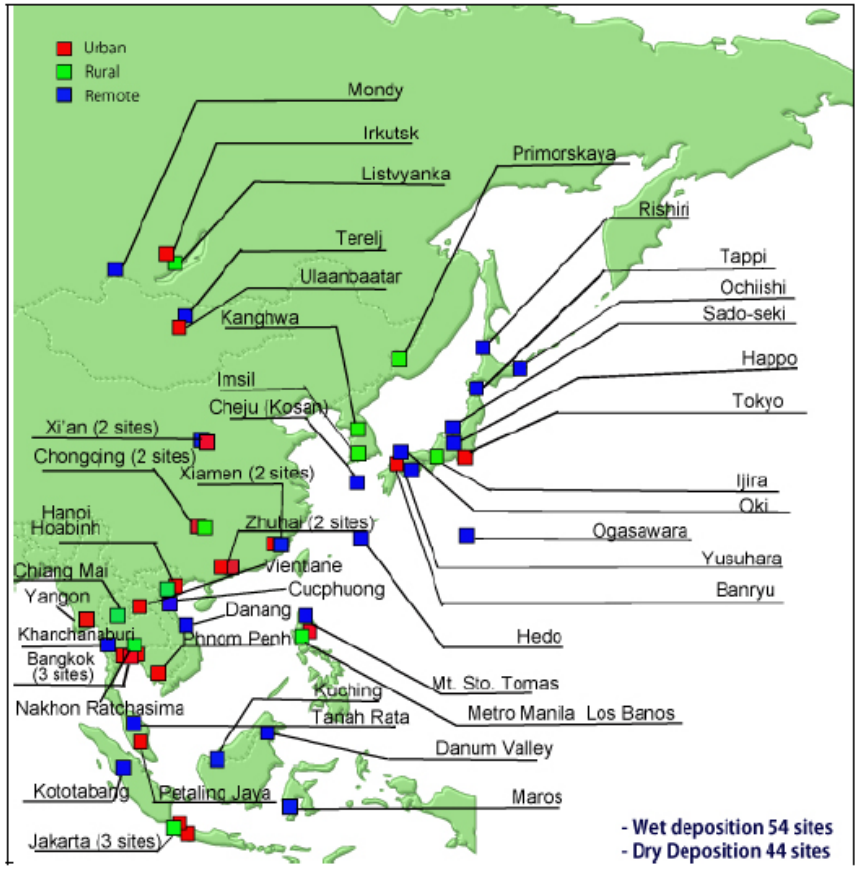


Figure 2.1. EANET deposition monitoring sites (2009)

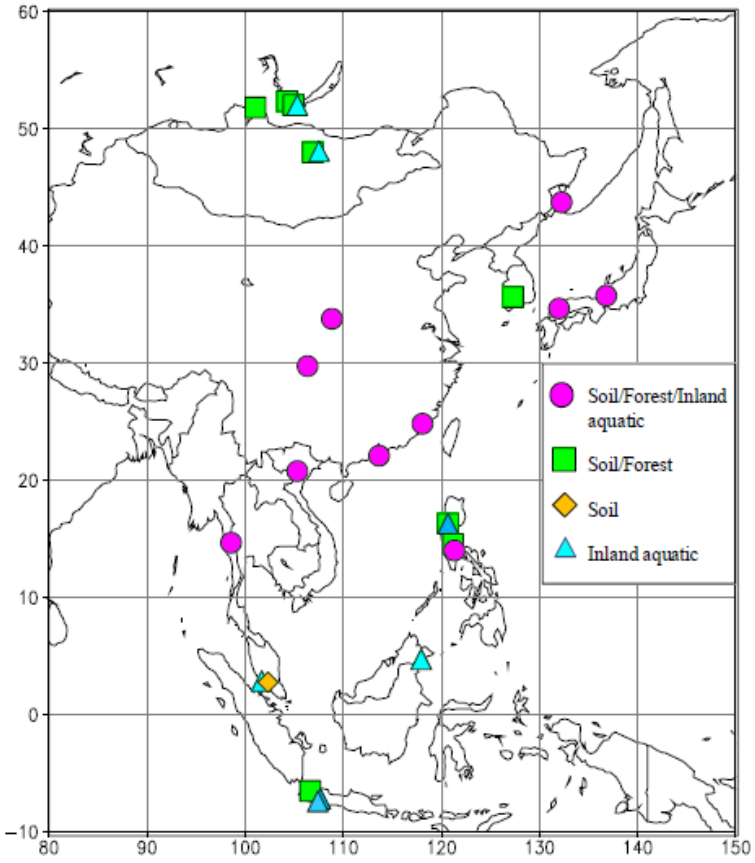


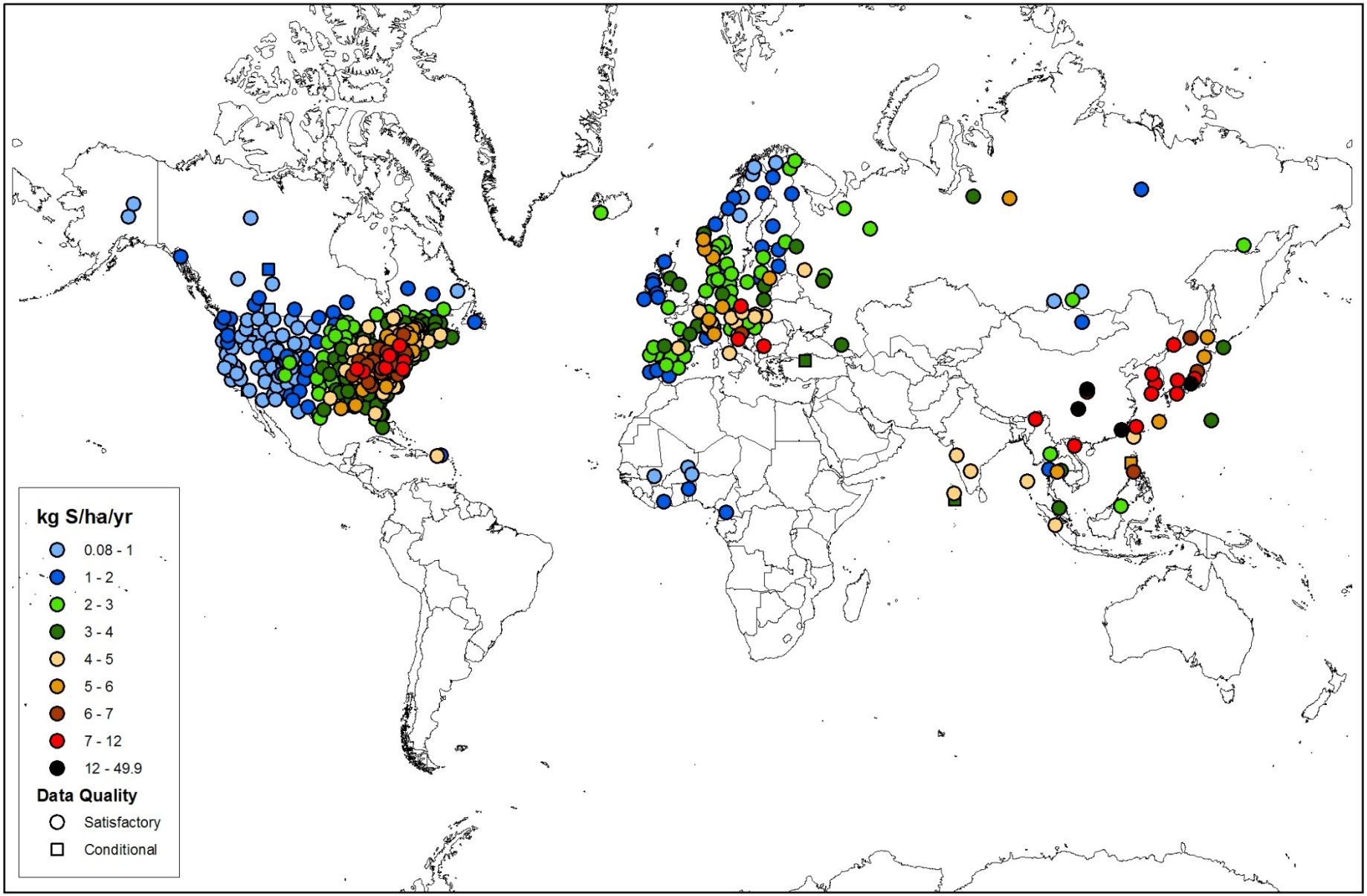
Figure 2.2. EANET ecological impact monitoring sites (2009)

- *Soil: 19 areas (27 forests)*
- *Forest vegetation: 18 areas (26 forests)*
- *Inland aquatic environments: 17 lakes/rivers*

http://www.eanet.cc

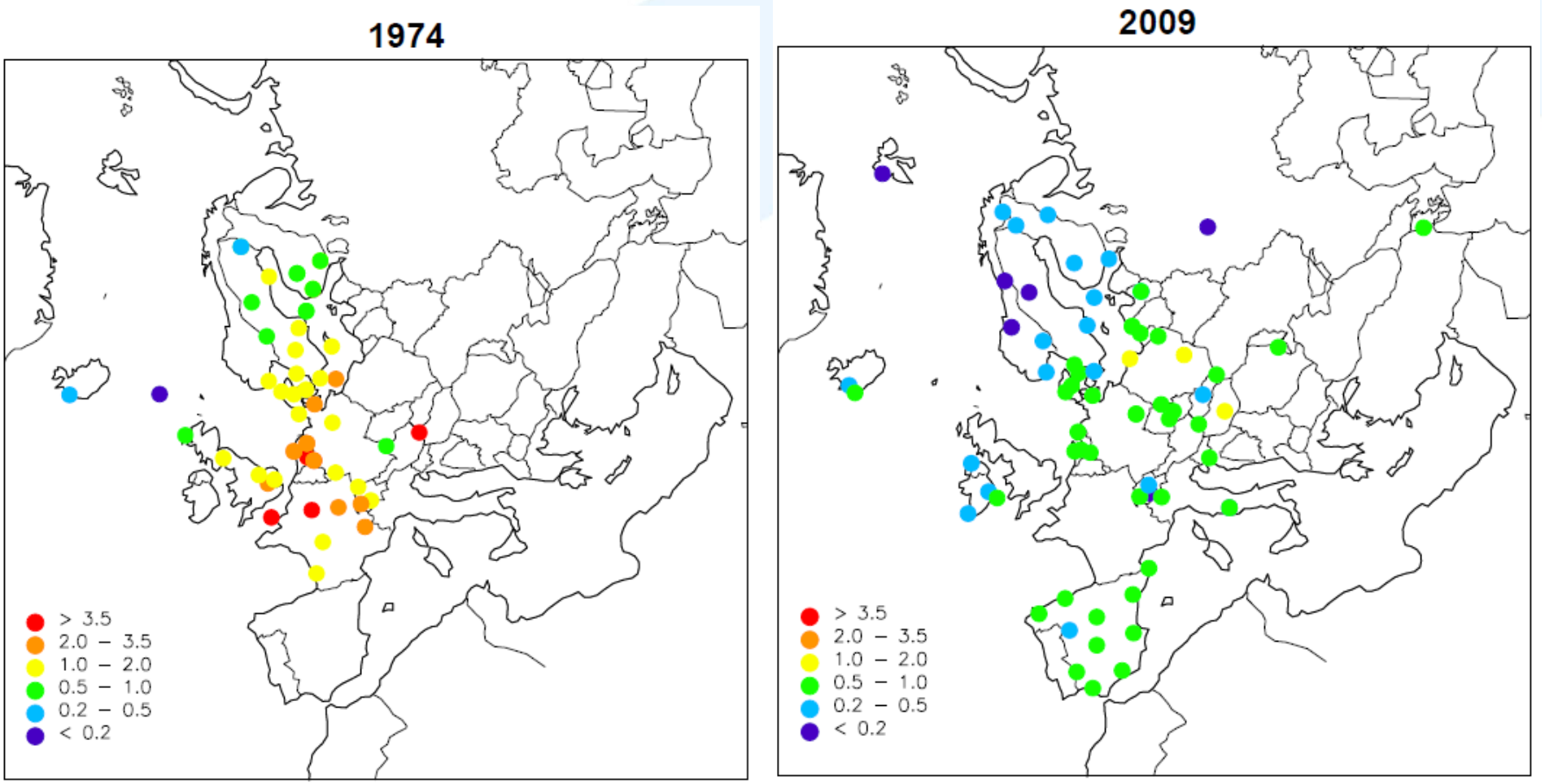
Sulphur

3-Year (2005-2007) Mean nss-Sulphur Wet Deposition (kg S/ha/yr)



Preliminary map, not to be redistributed

Concentration of sulphate in precipitation in Europe (1974-2009),mgS/L

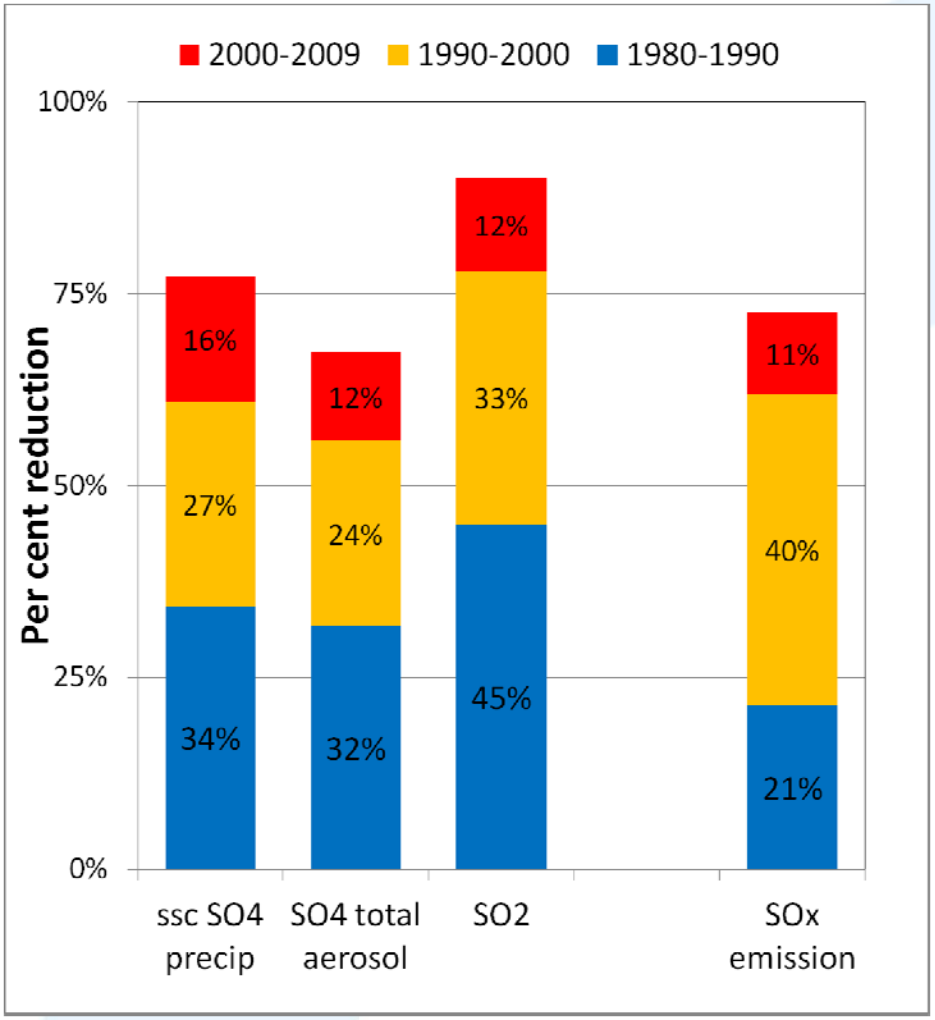


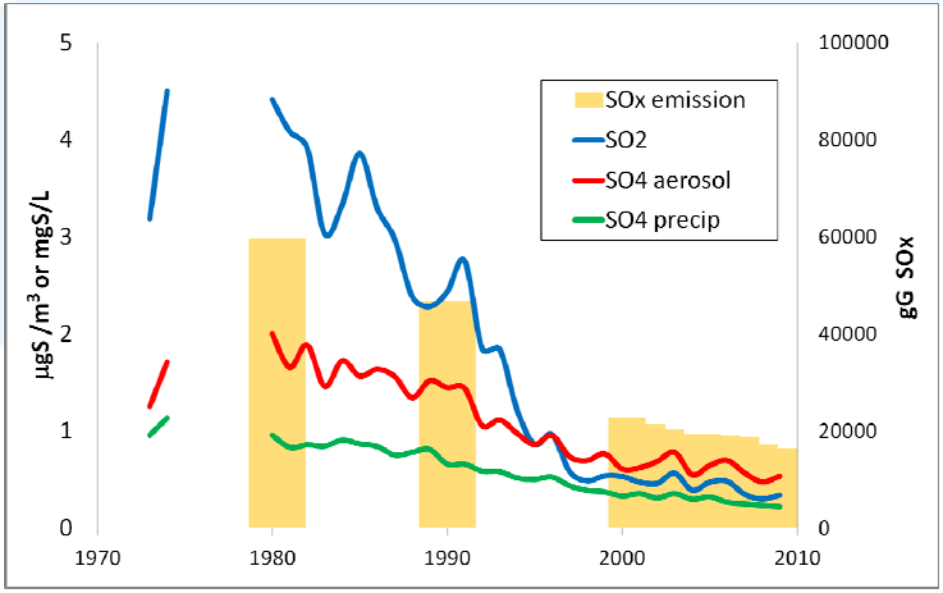
NILU

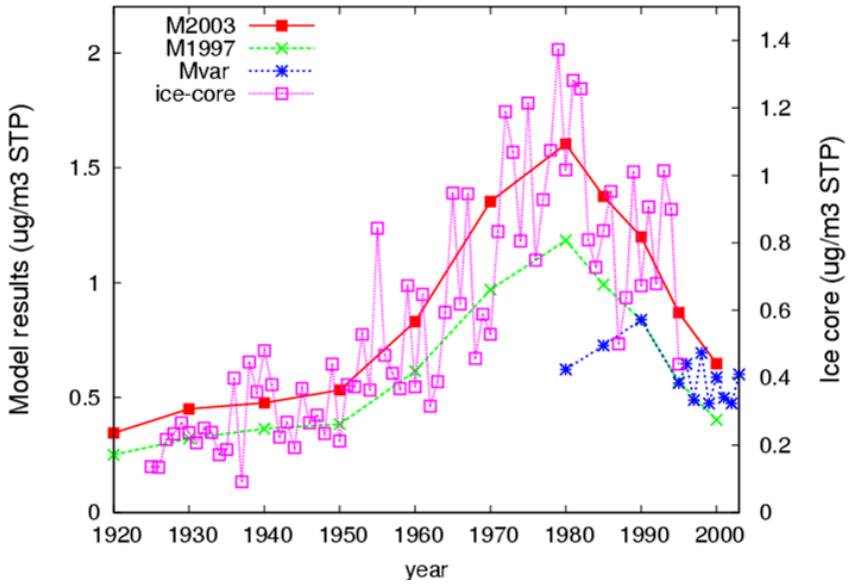
emep

Trends in sulphur in Europe

Ref: Tørseth et al, ACP, 2012

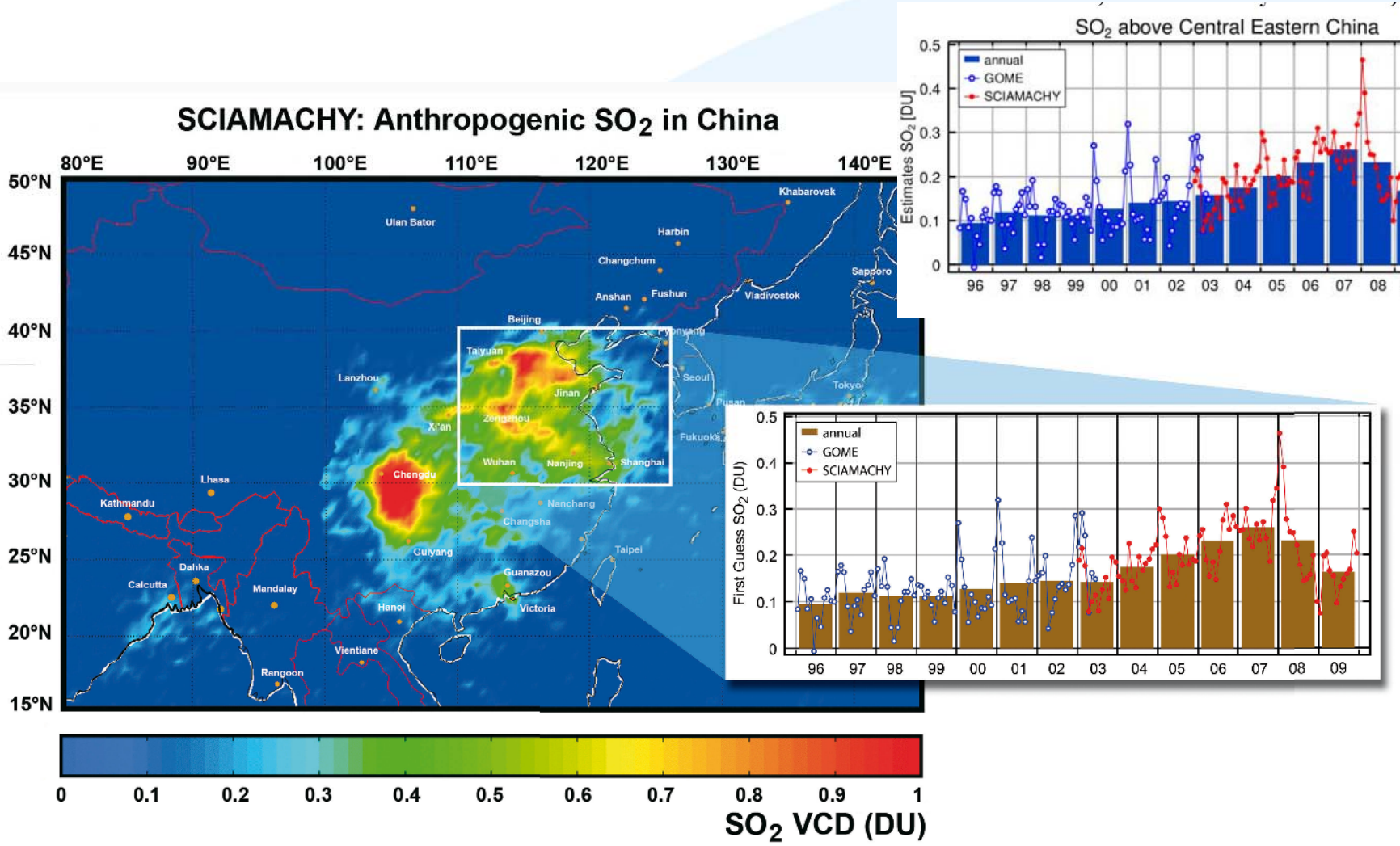






NILU emep

Trends in SO_2 in China

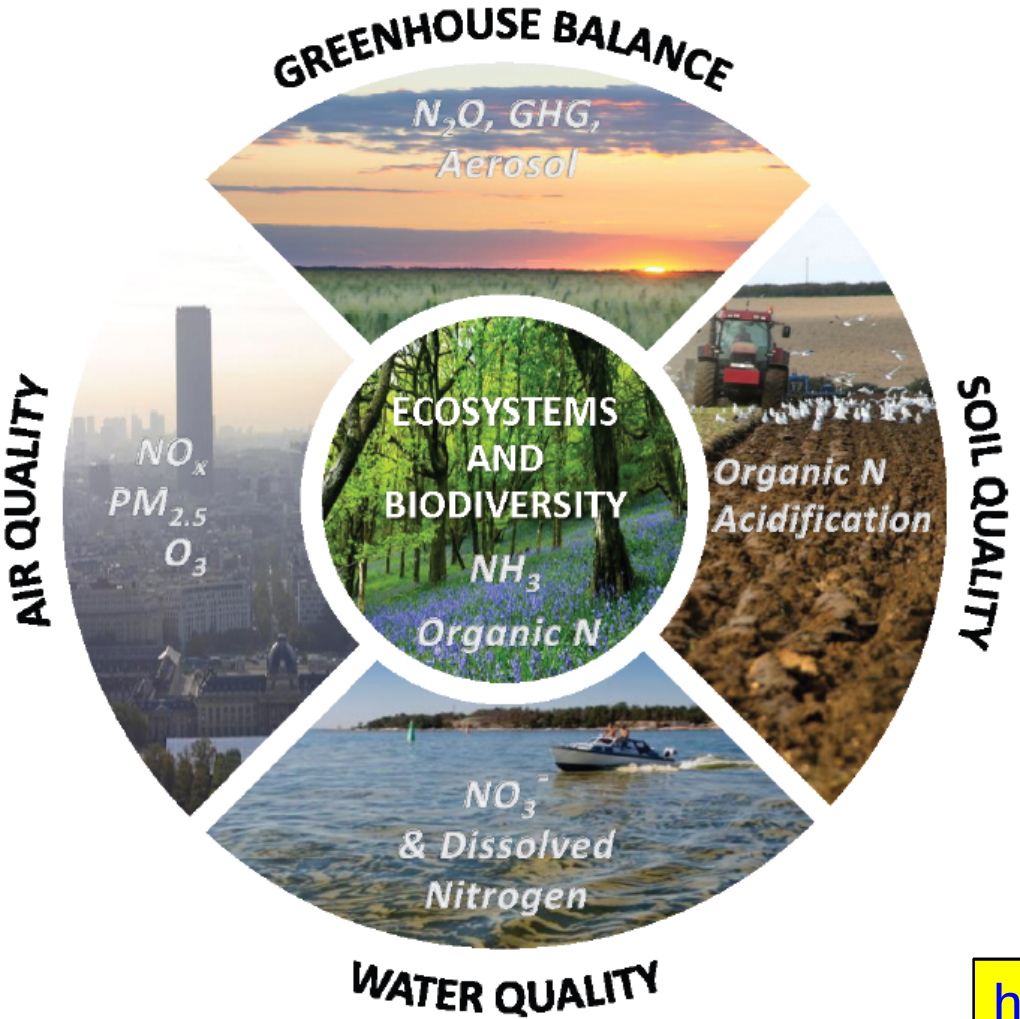


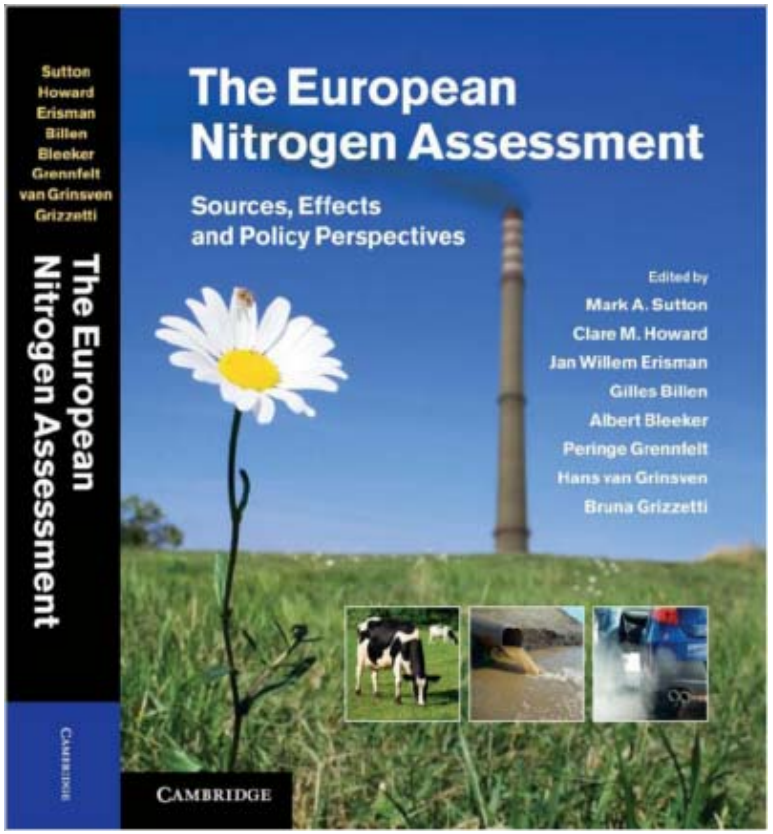
Universität Bremen

IUP - NEUIGKEITEN

In courtesy: A. Richter, IUP-IFE, University of Bremen

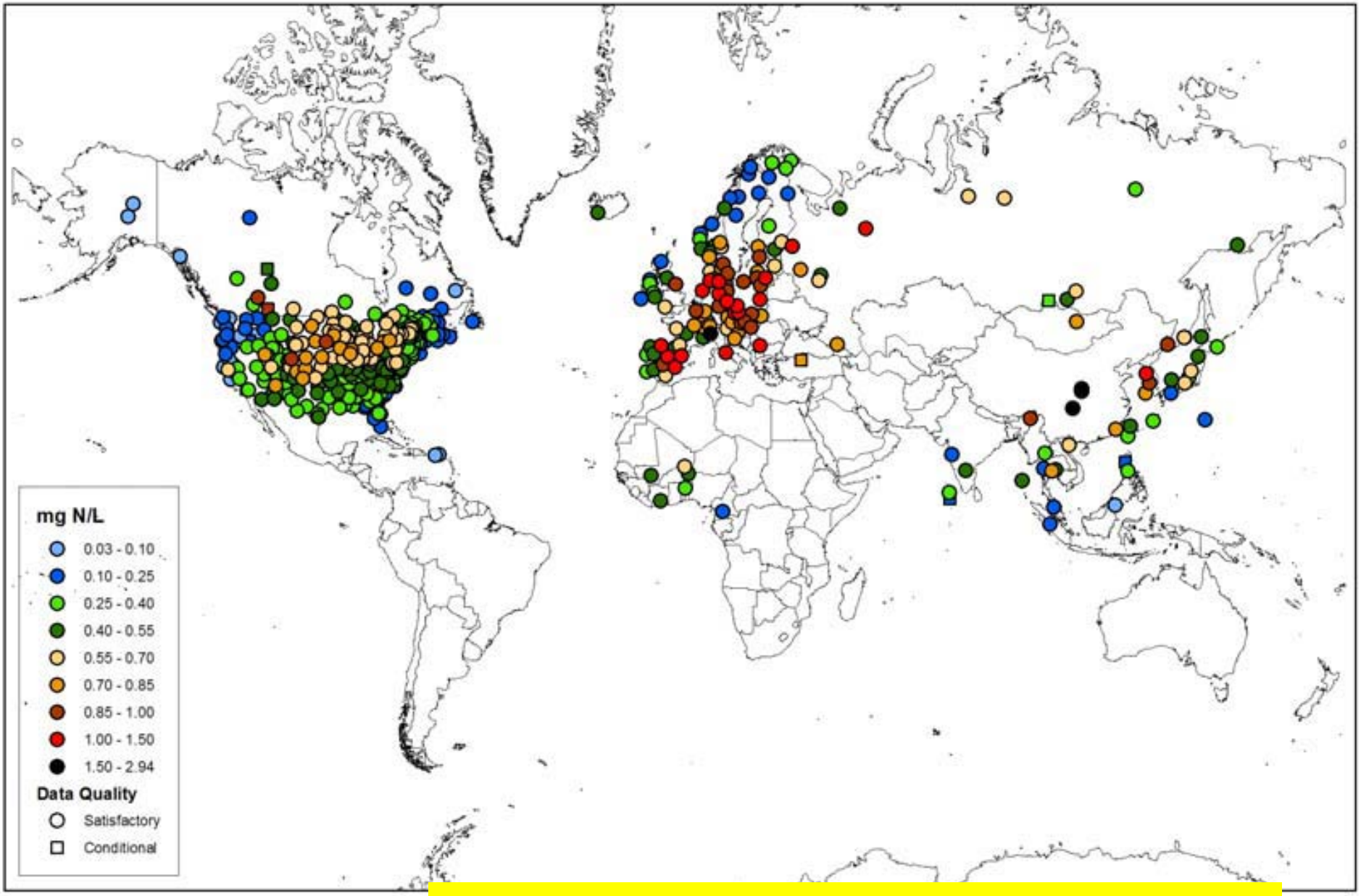
Nitrogen, important component across prioritized environmental themes



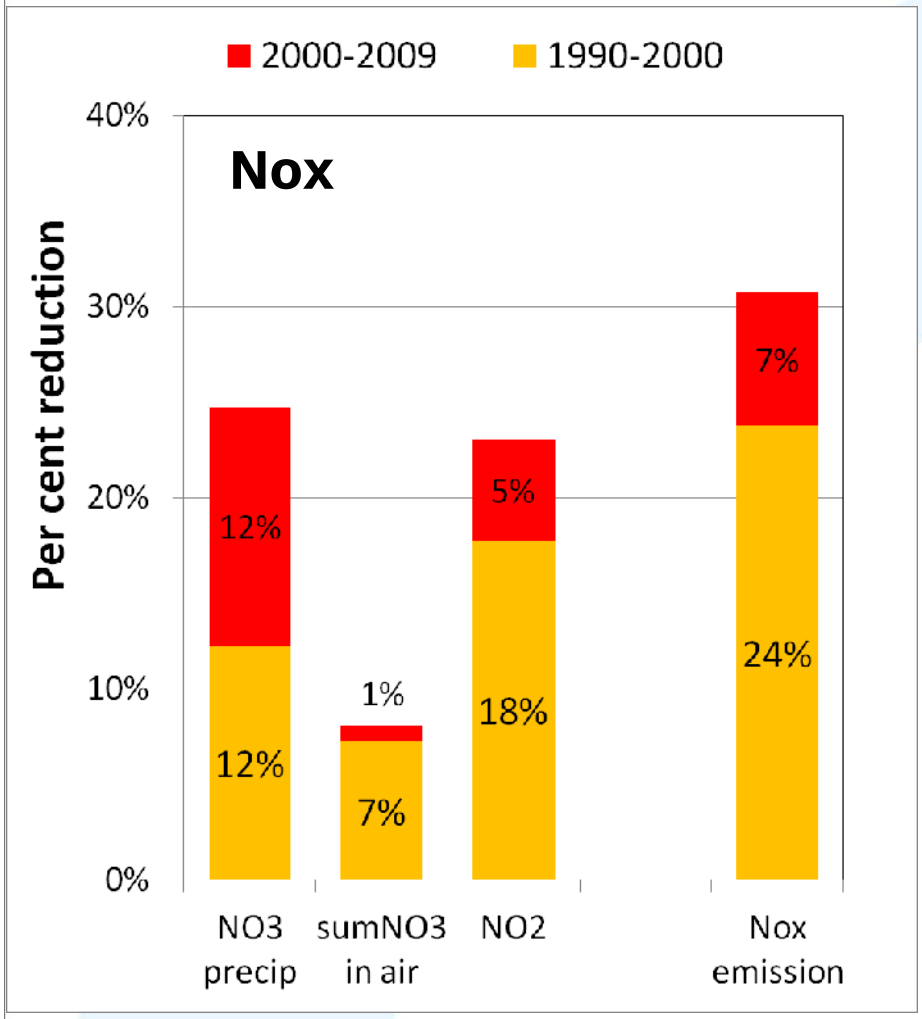


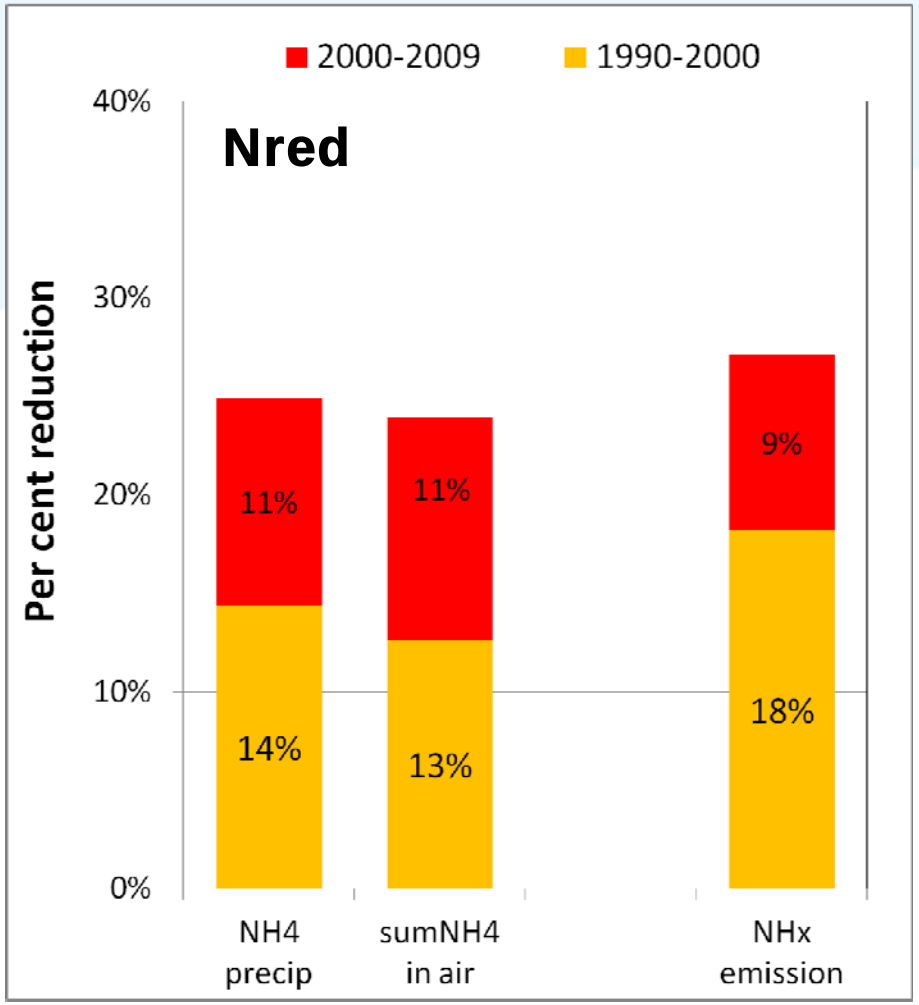
http://www.nine-esf.org/ENA-Book

3-Year (2005-2007) Mean Nitrogen (from Nitrate+Ammonium) Concentration (mg/L)



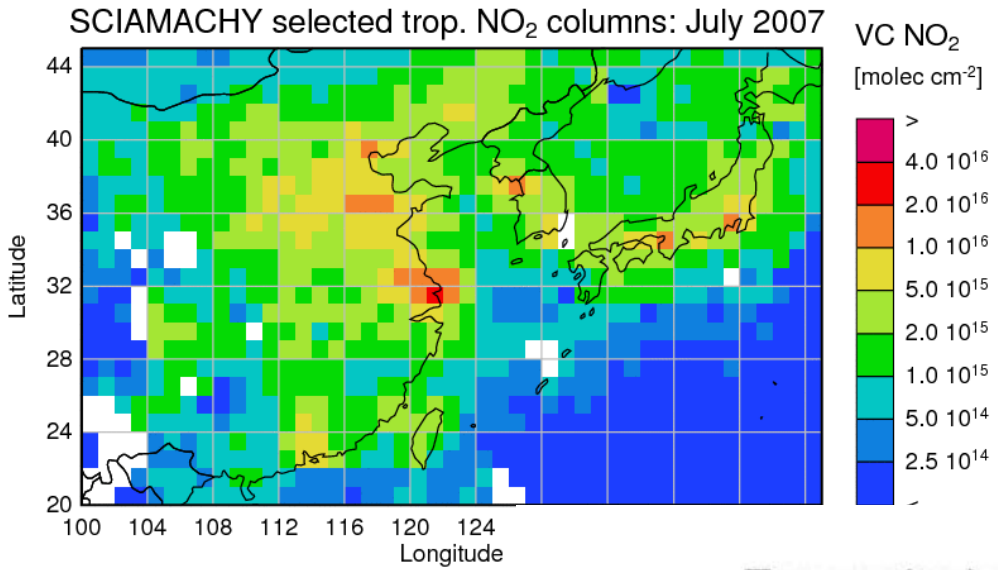
Trends in Nitrogen in Europe

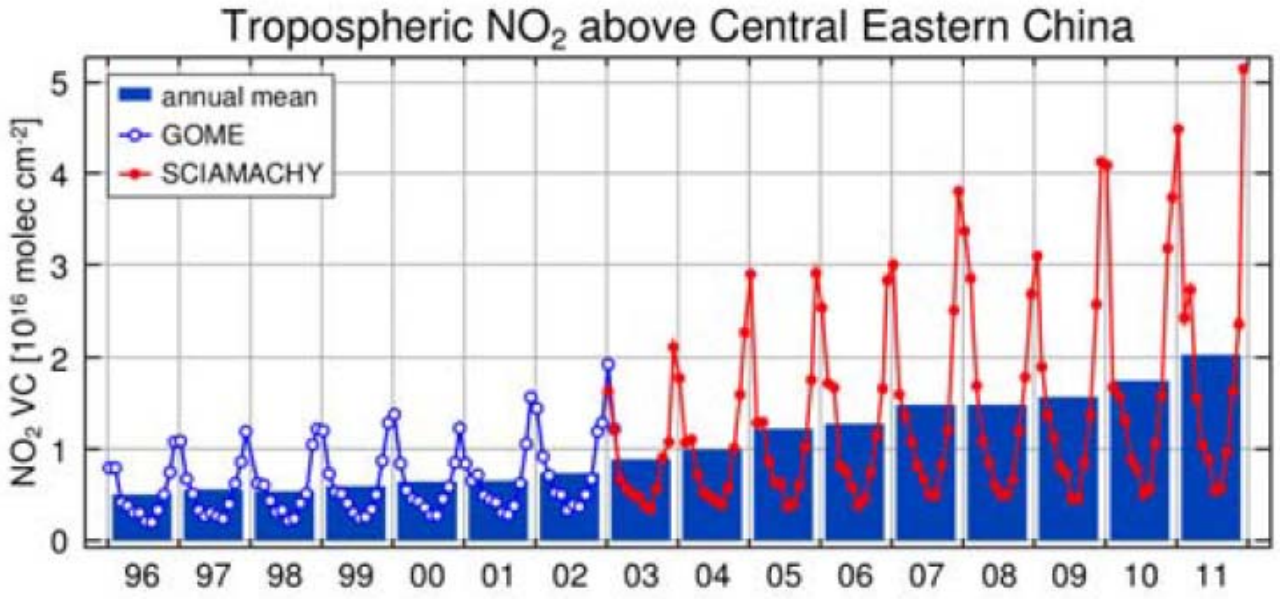




Ref: Tørseth et al, ACP, 2012

Trends in NO_2 in China



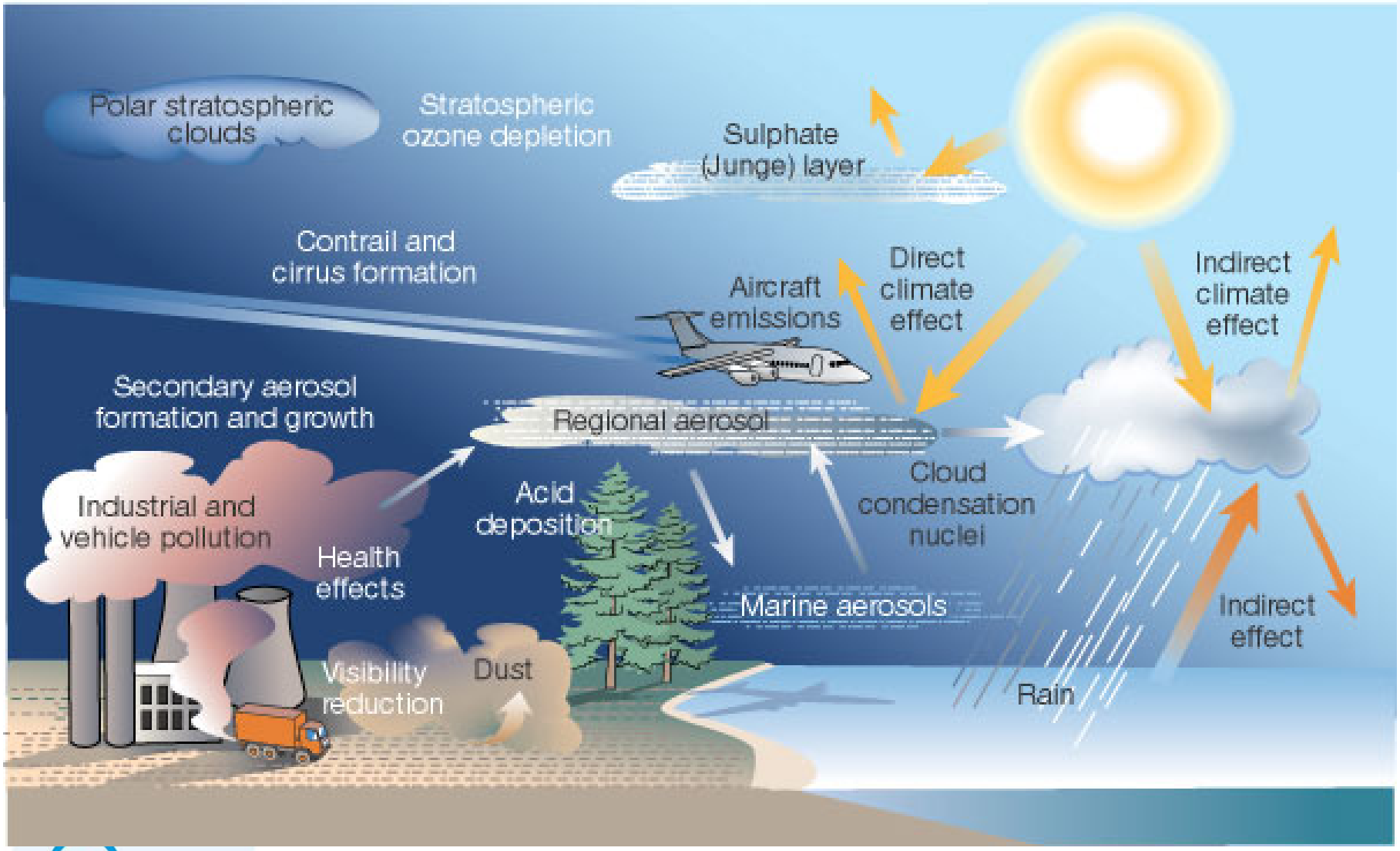


Universität Bremen

IUP - NEUIGKEITEN

In courtesy: A. Richter, IUP-IFE, University of Bremen

Aerosols



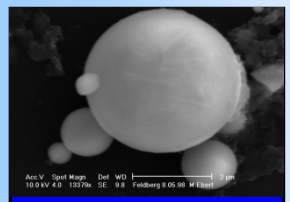
NILU

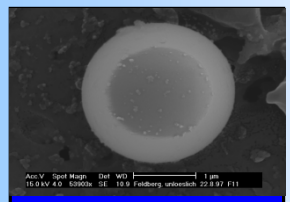
Umweltmineralogie
TU-Darmstadt

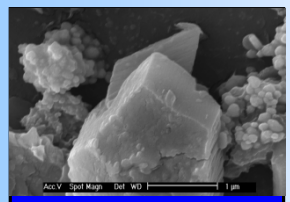
particle group

primary anthropogenic

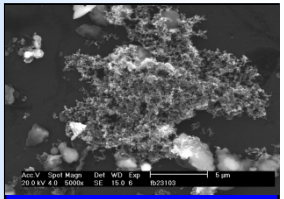
industrial

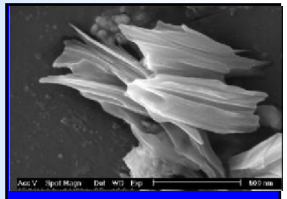

silicate-flyash


Al-, Ti-, Fe-oxide

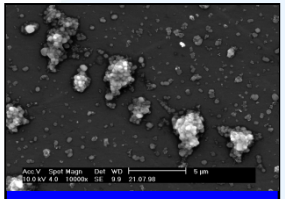

Calcium sulfate

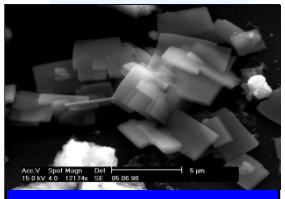
carbonaceous

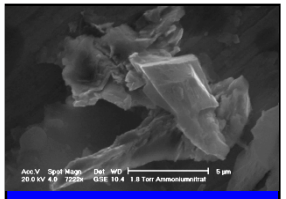

soot

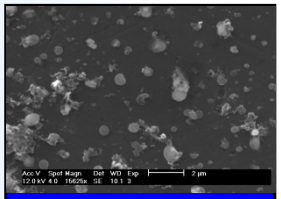

organic

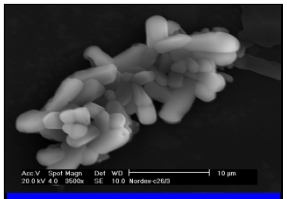
secondary

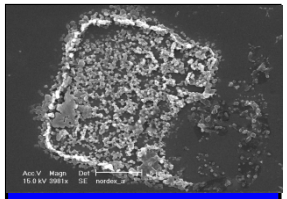

ammonium sulfate


Calcium sulfate


ammonium nitrate

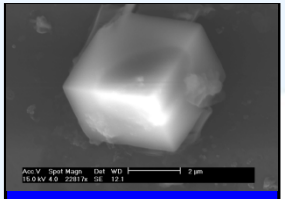

C / SO_4


aged sea salt

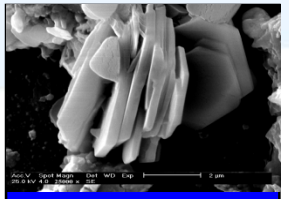

sea salt / silicate

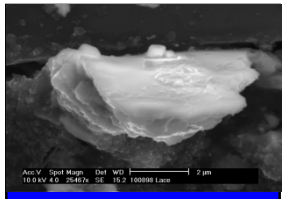
primary natural

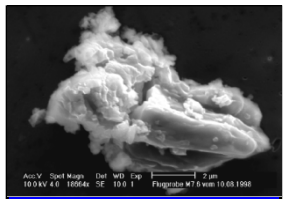
sea salt


sea salt

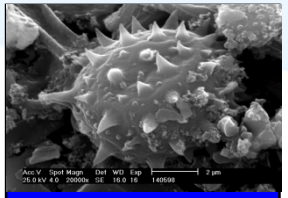
soil


silicate


quartz


metal oxide

carbonaceous

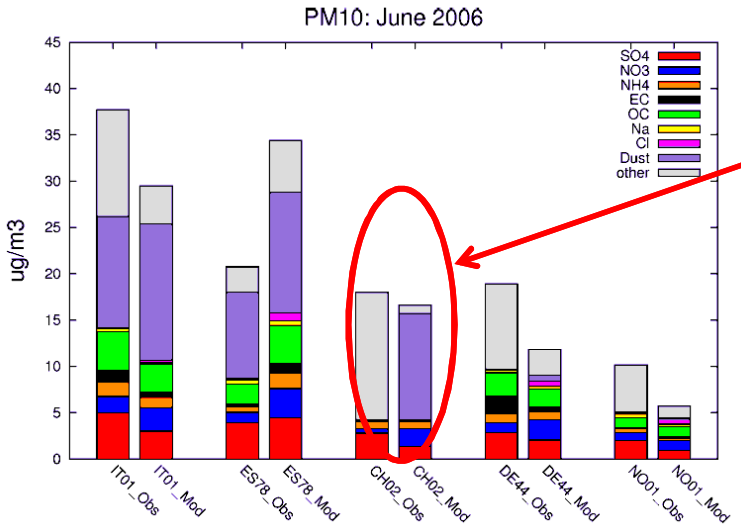

biological

Chemical composition of aerosols (model and measurements)

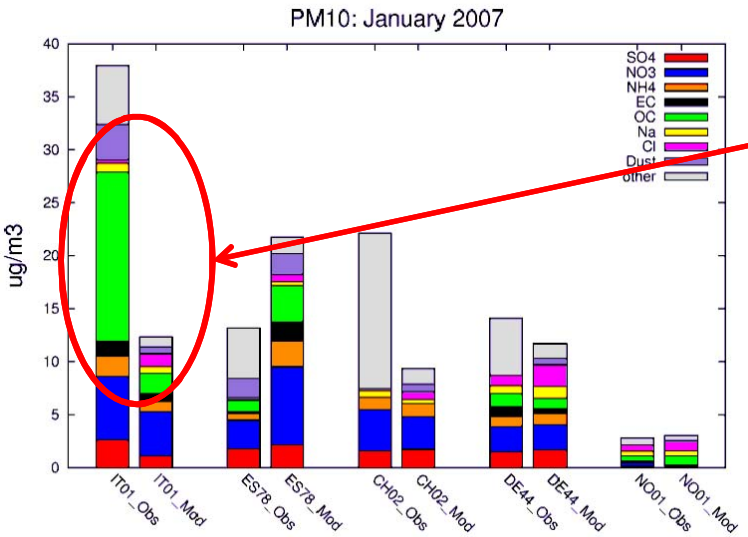
ACPD
12, 3731–3780, 2012

The first EMEP intensive measurement periods

W. Aas et al.



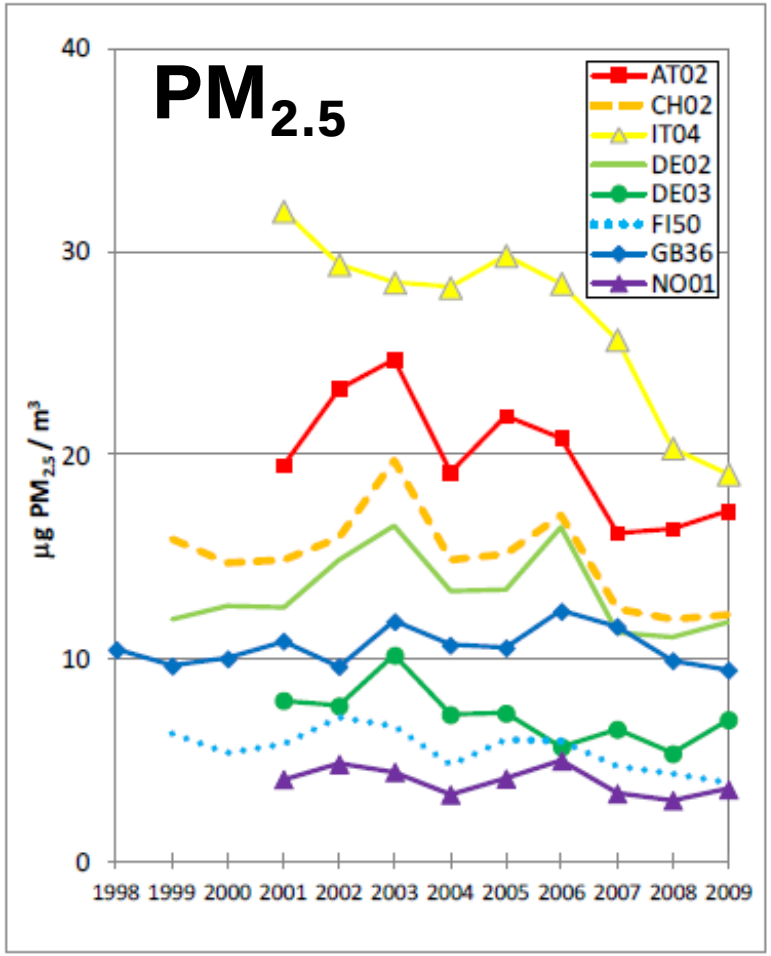
Missing measurements of mineral dust

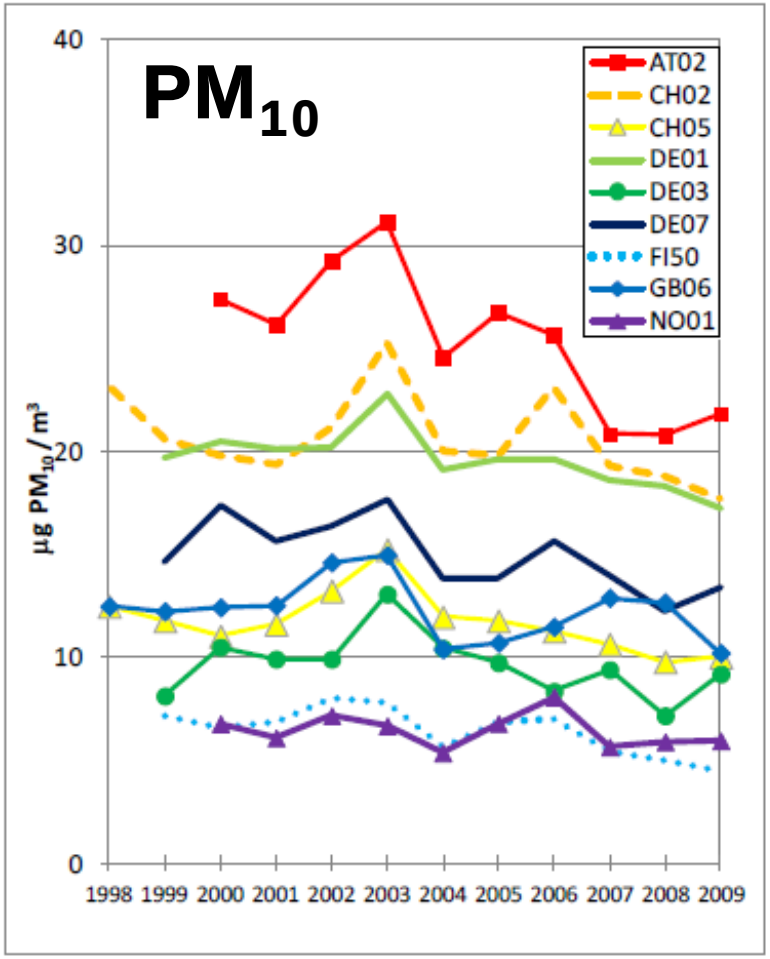


Missing emission inventories of carbonaceous matter

emep

Trends in PM in Europe.





Trends 2000(1) - 2009					
		Sites with sign. trend		Per cent change	
Comp	Nr of sites	decrease	increase	Avg.	SD
PM_{10}	24	50%	0%	-18%	13%
$PM_{2.5}$	13	46%	0%	-27%	12%
PM_{10} - $PM_{2.5}$	11	18%	9%	-4%	24%

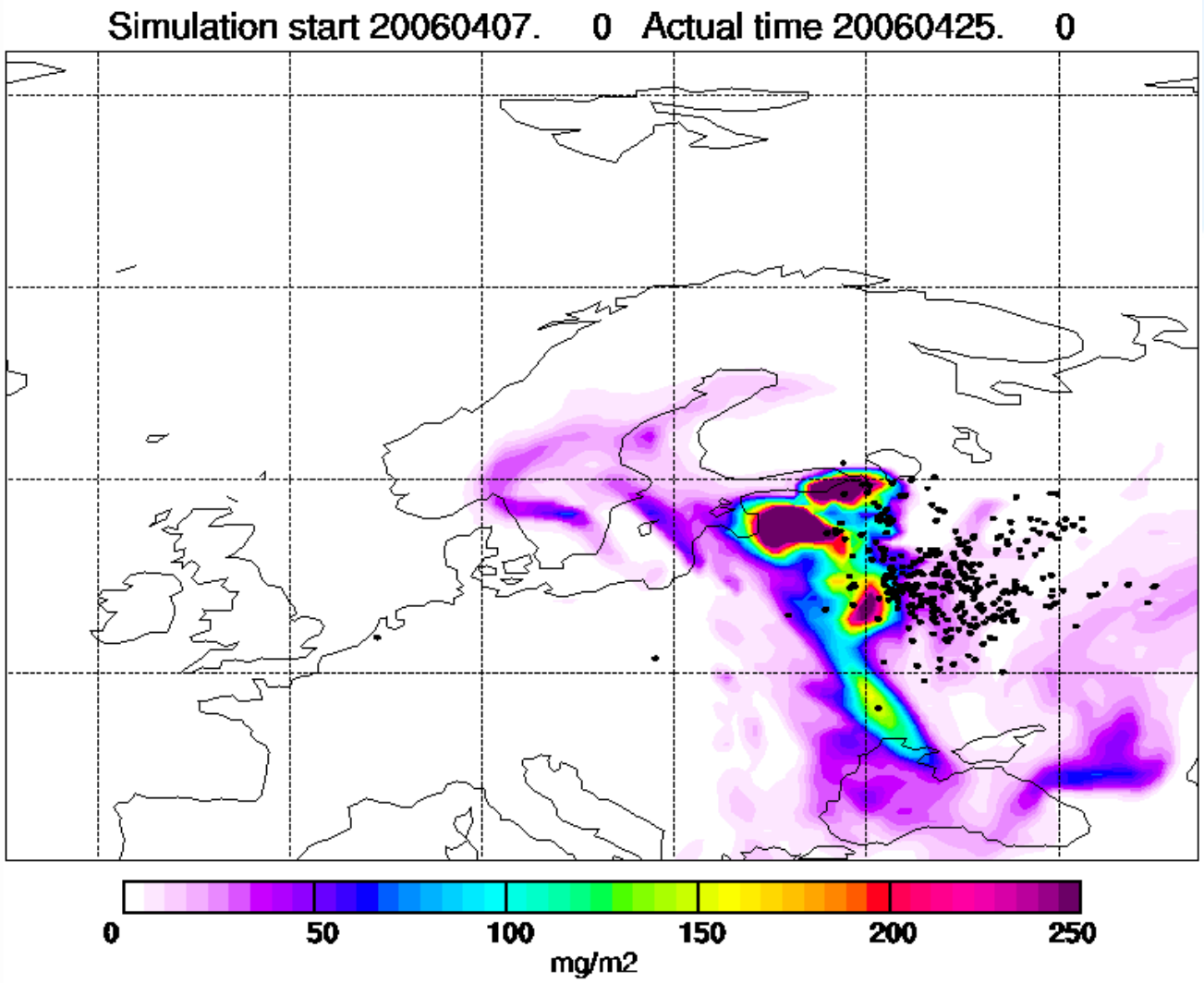
Ref: Tørseth et al, ACP, 2012

Aerosol episode in the Arctic

Zeppelin in May 2006

Photos; Ann-Christine Engvall,Univ. Stockholm.

Transport of agricultural fire emission plumes

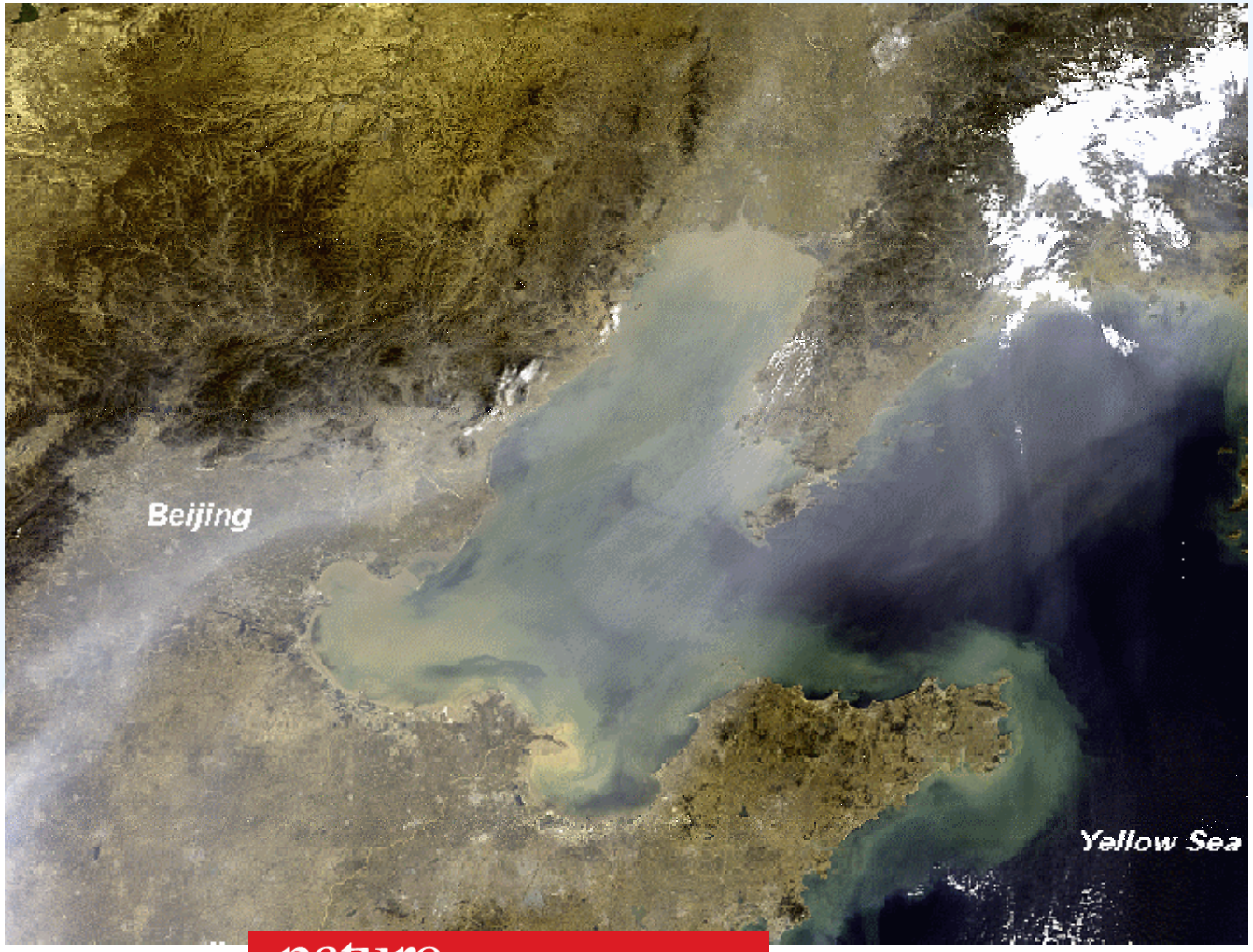


Stohl et al., ACP, 2007

Thick Smog over Beijing, China

Thick Smog over Beijing, China.

Thick pollution obscured the sky over Beijing and nearby regions on November 4, 2004.



earthobservatory.nasa.gov/Newsroom/
www.esa.int – News 1. Sep 2005

nature International weekly journal of science

Nature **437**, 129-132 (1 September 2005) | doi: 10.1038/nature04092

Increase in tropospheric nitrogen dioxide over China observed from space

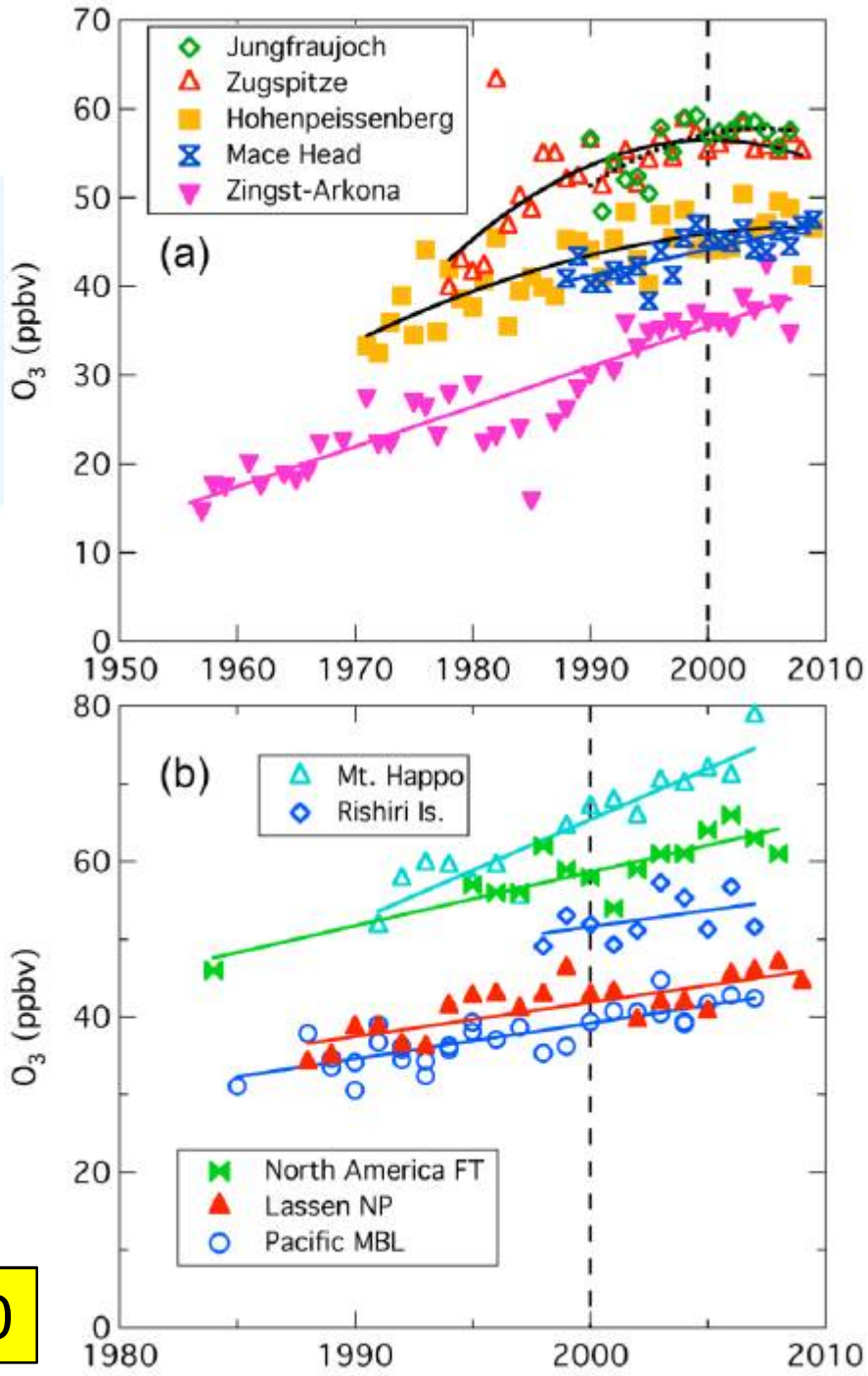
Andreas Richter[1], John P. Burrows[1], Hendrik Nüß[1], Claire Granier[2,3,4] and Ulrike Niemeier[2]

NILU

Tropospheric Ozone trends

Tropospheric ozone is often called "bad" ozone because it can damage living tissue and break down certain materials. Additionally are related to the formation of aerosols, and is a greenhouse gas.

- Many sources has changed: NOy CH4, VOC, CO
- Increase in background level, but large regional variations
- Meteorology an complex chemistry increase the uncertainties

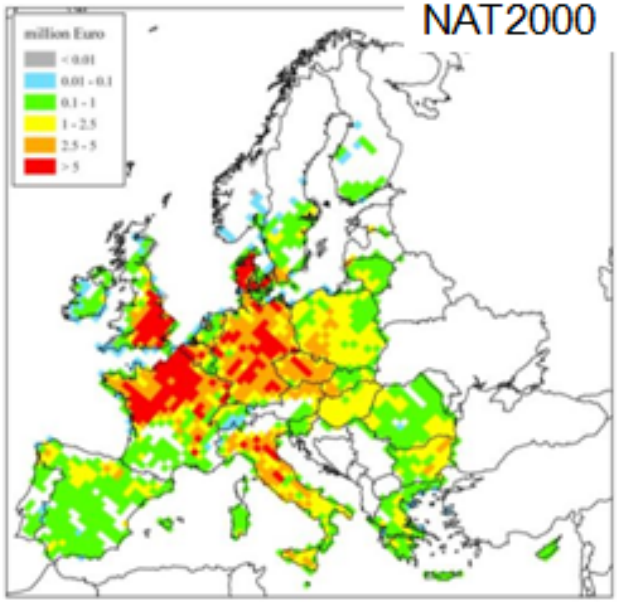


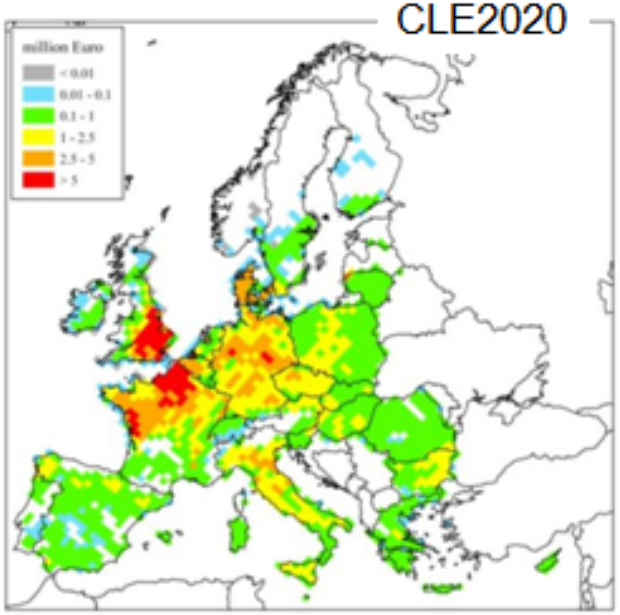
Ref: HTAP, 2010

Ozone

POD_6 (mmol.m^{-2})

ICP Vegetation:
Ozone is of concern for food security





Ozone impact on wheat production

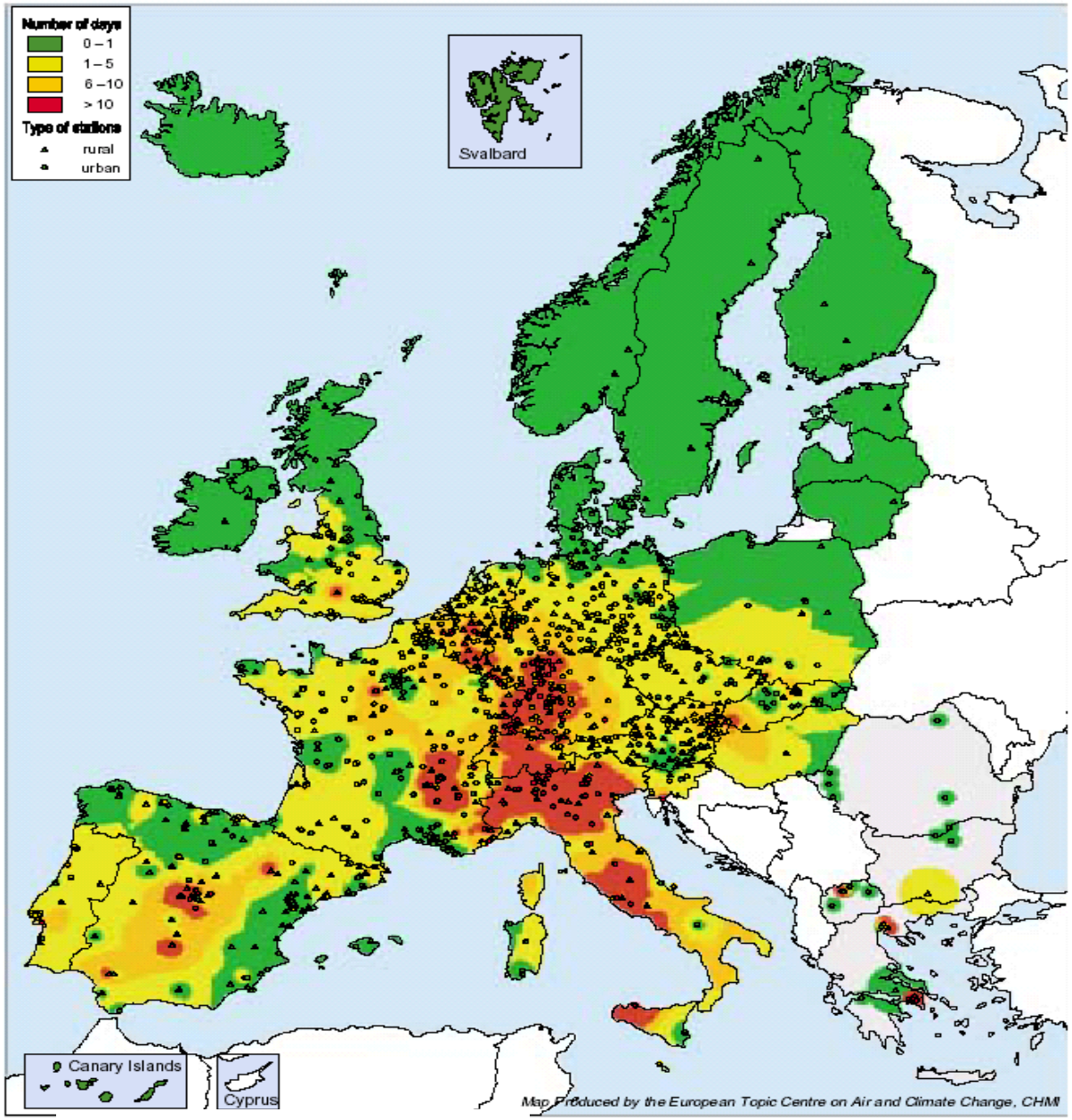
Wheat	2000	2020
Total production	133 MT	
Production loss	27 MT	16 MT
economic value loss	3.2 b€	2.0 b€

The magnitude of the impact is reduced

The areas (intensely) impacted are reduced

The impact occurs on 85% of EMEP grid cells

Number of exceedances of the threshold value for the information of the public (one-hour ozone concentration > 180 µg/m³) observed at rural and urban background stations, summer 2003 (April–August), interpolated using inverse distance weighting

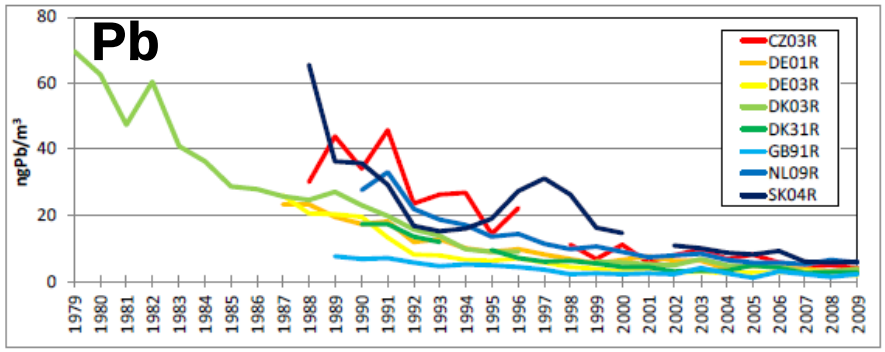


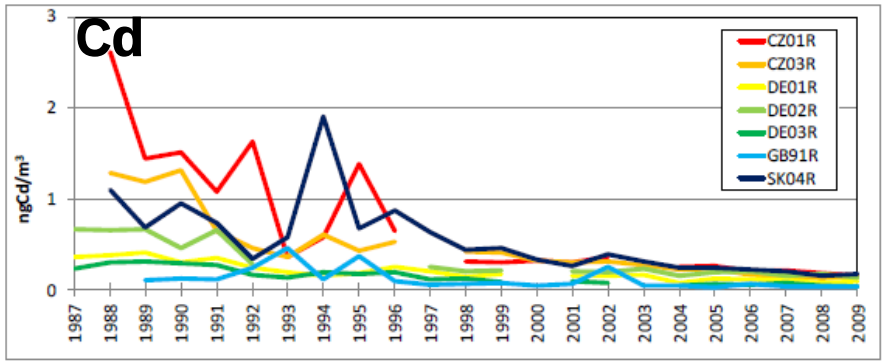
Summer 2003

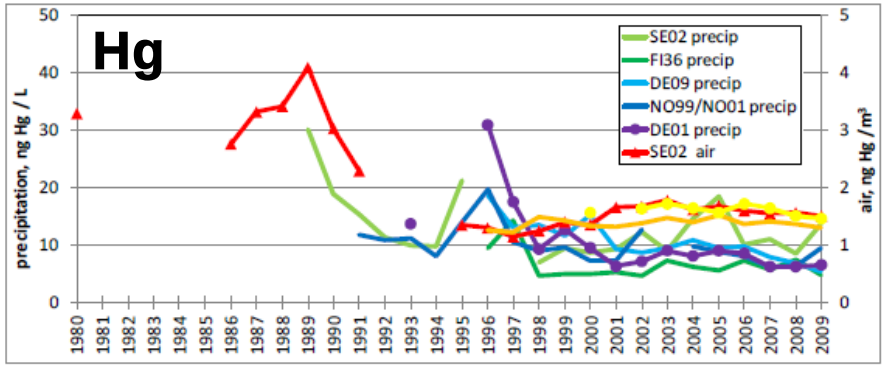
Ozone is a large health problem in Europe

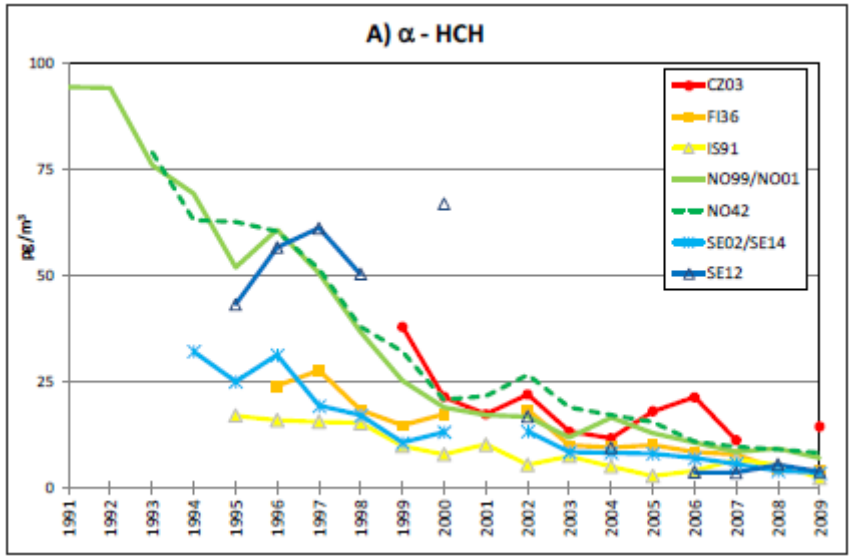
ETC/ACC

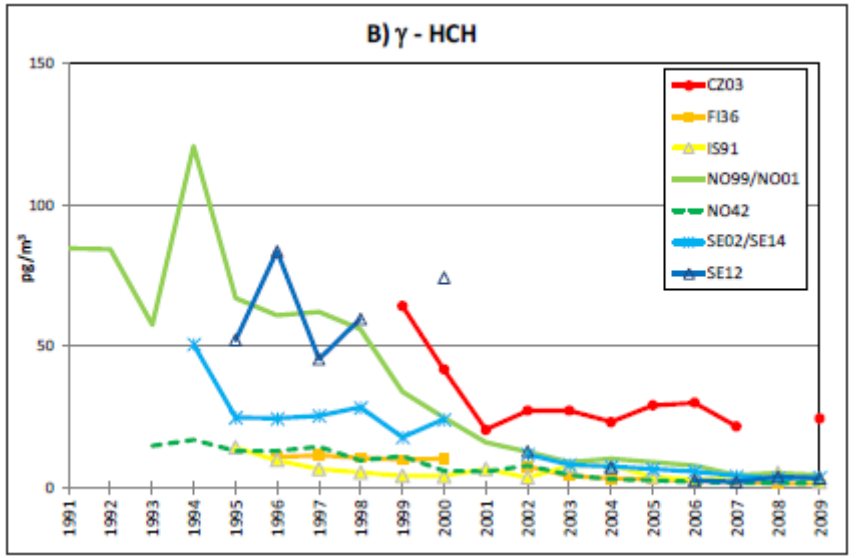
Trends in regulated heavy metals and POPs







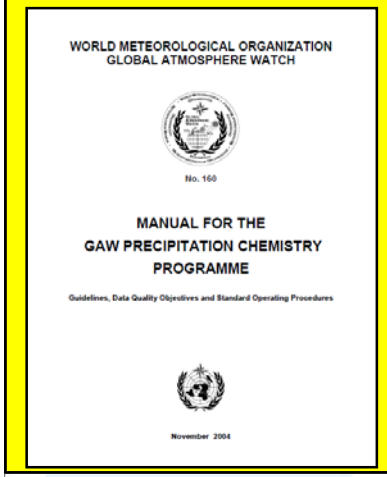


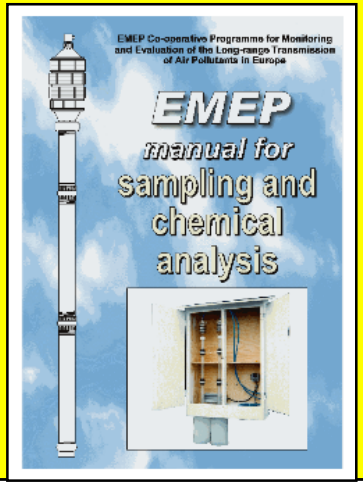


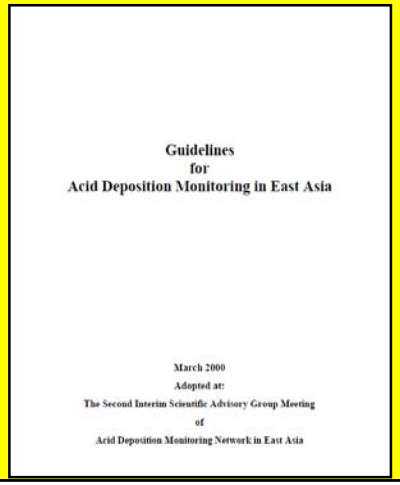
Data quality

- Essential to have **harmonized measurements** to be able to do comparison over time and space
- Standard operation procedures and reference methods developed
- Regular field and laboratory inter comparison

Monitoring frameworks:







ISO International Organization for Standardization

Infrastructure projects

EUSAAR
EUropean Supersites for Atmospheric Aerosol Research

ACTRiS

InGOS

Sources of uncertainties

Sampling and analytical method

- Detection limit
- Interference
- Instrument drift, calibration
- Positive or negative artefact

Lab- and field intercomparison Ion balance plot

Sampling procedure

- Contamination
- Temperature and period for storage
- Transport

Field inter-comparison; model comparison

Representativity.

- Local farming (NH_3)
- Nearby roads (NOx; O_3)
- Dust (PM, Ca..)
- Local heating (SO_2, PM, EC/OC)

Repr. studies, i.e passive sampling. Model comparison

NILU

Lab intercomparisons annually

	Precipitation										Air and aerosols		
	SO_4^{2-}	NO_3	NH_4	pH	Mg	Na	Cl	Ca	K	Cond	SO_2	HNO_3	NH_3
1 AT	0.6	0.2	1.4	0.3	3.1	1.3	4.2	2.8	1.6	0.9			
21 CH	0.7	0.6	1.0	0.0	1.2	0.4	1.1	0.7	2.9	0.3	1.0		
24 CS	0.4	0.7	1.0	0.1	2.8	1.4	2.1	2.2	1.3	0.5			
3 CZ	0.9	0.3	10.5	0.5	1.2	2.3	1.3	3.2	1.3	1.2	8.1	3.3	
7 DE	0.6	0.5	1.1	0.1	0.8	1.2	0.9	0.7	1.0	3.0			
8 DE Leipz	0.1	0.3	0.7	0.0	0.8	0.4	0.8	0.5	0.3	1.4	5.1	2.1	8.3
4 DK	0.3	0.3	1.2	0.0	1.2	5.1	3.2	3.0	2.1	1.8	1.8	3.8	
38 EE	1.2	1.4	32.7	1.3	2.0	2.7	4.1	6.7	0.8	3.1	7.2		
19 ES	6.3	7.0	4.1	0.3	0.4	1.8	12.0	1.0	0.7	0.9	22.5		3.8
5 FI	0.9	1.7	2.6	0.3	2.8	11.2	9.6	2.3	2.8	0.8	5.0	2.1	4.8
6 FR	0.4	0.9	1.0	0.2	3.5	1.6	2.1	3.5	1.3	1.9	1.3		
23 GB	0.9	0.9	1.9	0.3	18.5	15.2	1.8	6.2	10.3	4.0	1.5		
10 HU	2.7	2.9	1.2	0.3	0.8	2.1	18.2	2.2	8.5	2.1			18.4
35 HR	1.2	2.0	0.8	0.2	9.8	3.7	1.3	8.8	8.3	1.1			
12 IE	0.5	1.1	2.6	0.2	2.0	1.3	1.8	2.0	2.1	0.4			
11 IS	2.0	6.0	11.4	0.3	2.4	0.7	12.5	1.5	5.2	1.6	8.0	5.9	4.8
13 IT	1.0	0.7	3.8	0.5	2.4	3.2	3.3	1.8	2.8	2.1			8.2
30 IT	0.5	3.4	11.4	1.0	1.2	0.3	3.6	1.7	9.5	1.2			
32 LT	3.2	0.6	3.0	0.1		2.1	3.1	45.1	1.6	1.0	2.8	2.8	14.6
33 LV	2.3	2.4	1.2	0.2	1.6	0.2	6.8	1.8	0.7	0.6	4.4	12.4	6.3
40 MK		9.9	89.2	1.3	31.3	1.1		183.1	7.1	16.6			
14 NL	0.5	3.5	0.5	0.3	3.9	2.0	5.6	1.8	7.0	1.2			
15 NO	0.5	0.7	1.2	0.2	3.5	1.4	1.1	1.5	0.5	1.4	8.1	5.5	5.7
16 PL	0.9	0.7	3.4	0.2	2.0	2.7	1.6	3.7	4.1	1.0	1.8	1.0	
39 PL05	1.5	2.4	0.8	0.4	0.4	0.5	2.5	0.8	0.8	1.3	8.6	1.8	6.2
17 PT	11.2	2.5	4.9	0.9	5.1	4.1	22.3	3.5	5.4	1.9	4.6		
22 RU	3.9	6.7	1.8	0.2	9.1	10.5	31.0	24.1	7.8	0.9	13.7	3.8	
20 SE	0.1	0.2	2.9	0.2	2.4	0.5	1.4	2.8	0.7	1.4	4.0	2.6	4.6
36 SI	0.6	2.1	2.2	0.2	2.0	1.3	7.0	1.3	0.3	1.3	4.5	2.1	3.0
31 SK	4.5	1.3	38.4	0.2	10.2	5.4	3.9	13.5	17.3	0.5	2.5	1.9	10.0
34 TR	0.7	2.6	11.8	0.3	4.7	2.0	2.9	4.5	3.6	6.6	3.0	1.6	26.5

1-2 DQO > 2 DQO

Spread: 2RSD %

	Precipitation										Air and aerosols		
	SO_4^{2-}-S	NO_3-N	NH_4-N	pH	Mg	Na	Cl	Ca	K	Cond	SO_2-S	NO_3	NH_3
1 AT	1	0	-1	-2	-9	-3	-11	-3	-5	-2			
21 CH	2	1	2	1	3	1	-1	4	7	0	-9		
24 CS	0	-2	-1	0	-2	-6	3	0	0	-1			
3 CZ	3	-1	20	0	6	-2	-2	14	-3	1	-12	-6	
7 DE	5	-1	-3	-1	0	-1	-2	0	-3	-5	2	4	4
8 DE	1	0	-2	2	1	-1	-3	4	-3	-5			
4 DK	0	0	1	1	-11	8	-3	-1	-10	-3	-5	-3	
38 EE	-1	-1	-107	-8	-17	-9	1	-28	-8	-11	-13		
19 ES	-7	1	8	3	1	2	-36	-2	2	2	-20		9
5 FI	3	4	1	1	4	4	8	6	4	3	4	10	-7
6 FR	-1	0	-1	0	-9	4	-2	7	-4	-3	-8		
10 HU	-1	11	-1	1	2	-6	-11	5	2	0			-24
35 CR	4	3	-2	2	51	-1	0	22	-1	-5			
12 IE	-1	-1	3	0	4	-5	-2	0	-4	1			
11 IS	-1	13	24	1	-3	1	7	-8	-8	-4	-10	25	6
13 IT	4	-1	3	-1	-4	-2	-3	2	0	-3			14
30 IT	-7	-12	-35	3	0	2	0	-2	-37	0			
32 LT	4	0	7	1		0	-2	40	0	-1	2	-3	5
33 LV	-1	-6	5	0	2	1	-7	2	0	-1	7	-15	3
40 MK		1	-7	-4	-4	1		100	-4	-22			
14 NL	2	14	-5	2	-4	6	-21	-1	4	3			
15 NO	3	2	11	2	11	2	-2	2	2	1	0	-6	-11
16 PL	0	-1	-1	1	2	5	-1	12	13	-4	4	2	
39 PL05	3	2	1	0	0	2	4	2	0	-4	9	6	-13
17 PT	-4	-1	-1	-6	17	-42	-72	-12	-34	0	-11		
22 RU	-2	-3	-30	2	-6	-7	-28	0	-5	-6	0	-8	
20 SE	-1	0	4	1	-11	-2	-5	-11	-3	-1	-4	-3	-4
36 SI	-1	8	1	1	-6	3	21	-2	-6	-2	3	8	-2
31 SK	-3	-4	39	1	-16	7	-4	-30	19	2	6	3	4
34 TY	2	-2	3	1	0	4	-2	2	-10	-8	-7	-16	-10
23 UK	1	0	4	-2	-24	29	-32	-9	-18	-6	-3		

systematic bias more than +- 20 % bias between 10 and 20 % or between -10 and -20 % bias

Bias: RB %

WMO lab intercomparison on precipitation chemistry

http://qasac-americas.org/

The Quality Assurance Science Activity Centre – Americas

HOME | PUBLICATIONS | STUDY RESULTS | RING DIAGRAMS | INTERCOMP STUDY 46

Ring Diagrams Overview

GOOD - Green Hexagon

Measurement is within the interquartile range (IQR), defined as the 25th to 75th percentile or middle half (50%) of the measurements. Examples: sulfate, ammonium, sodium, and potassium.

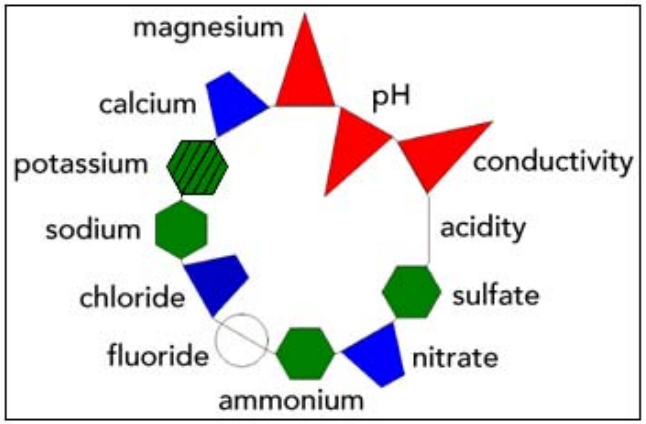
SATISFACTORY - Blue Trapezoid

Measurement is within the range defined by the median ± IQR/1.349. The ratio, IQR/1.349, is the non-parametric estimate of the standard deviation, sometimes called the pseudo-standard deviation. Examples: nitrate, chloride, and calcium.

UNSATISFACTORY - Red Triangle

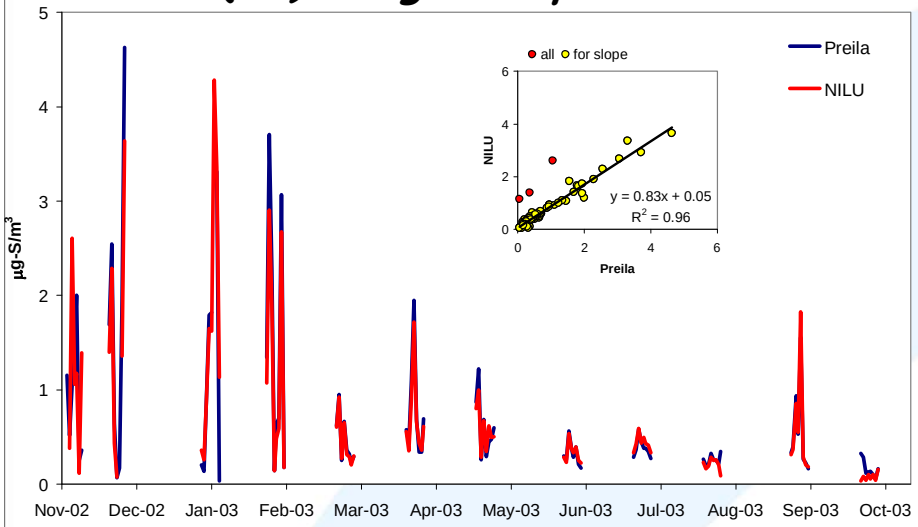
Measurement is outside the range defined by the median ± IQR/1.349. Examples: pH, conductivity, and magnesium.

DETECTION LIMIT - Open Circle

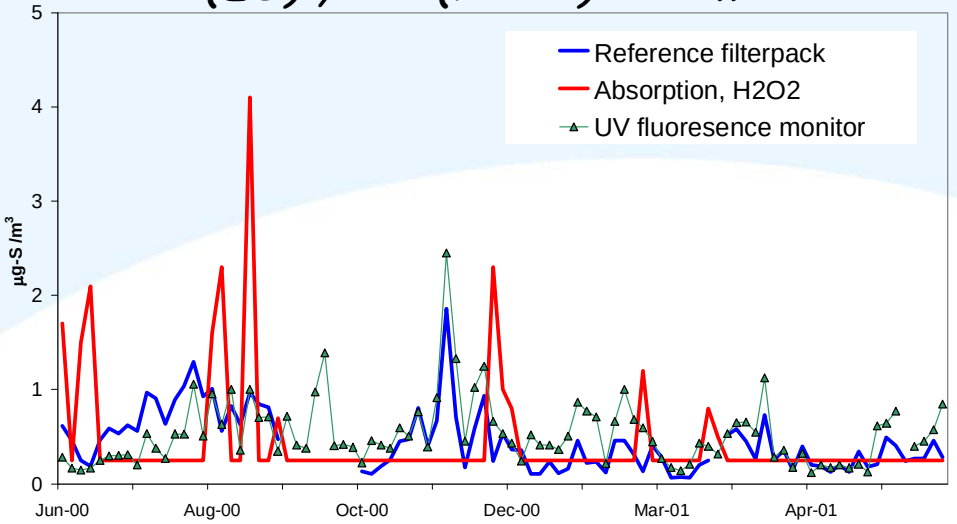


Field intercomparison (i.e. SO_2)

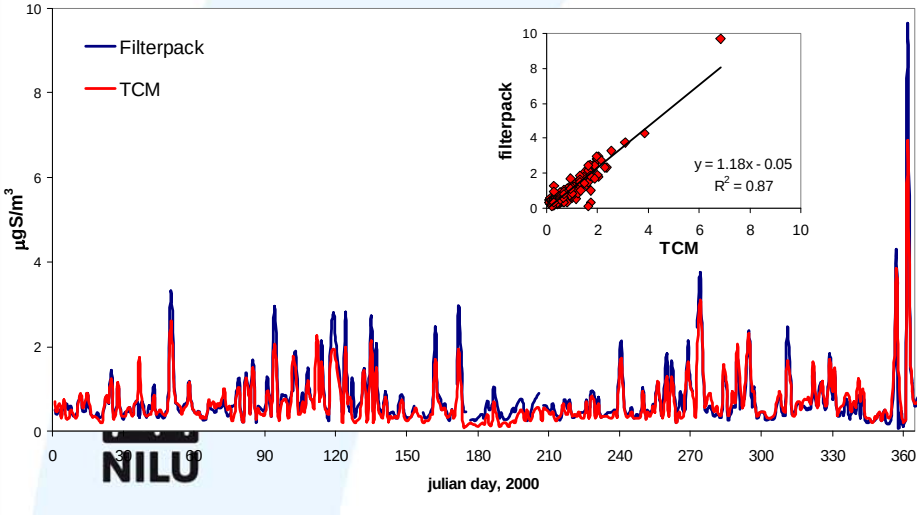
Preila (LT) using filterpack

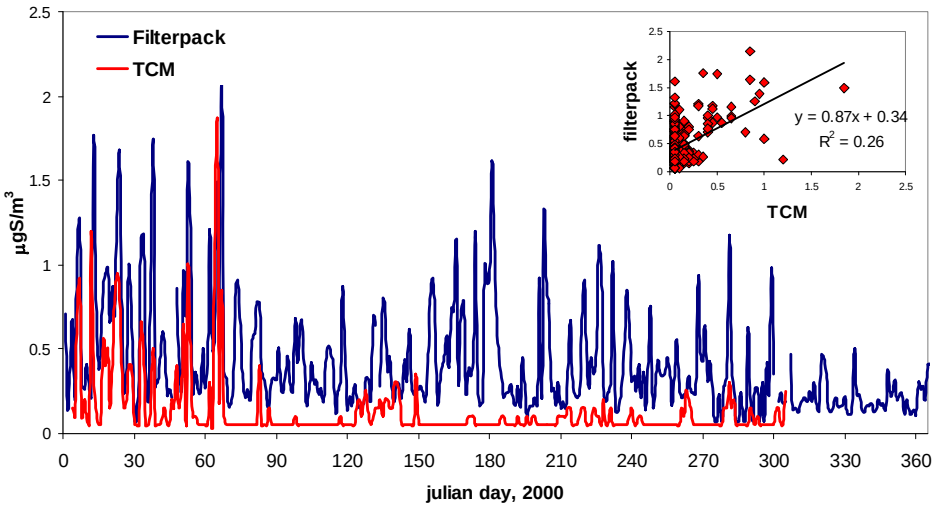


Zarra (ES) , abs (H202) and monitor

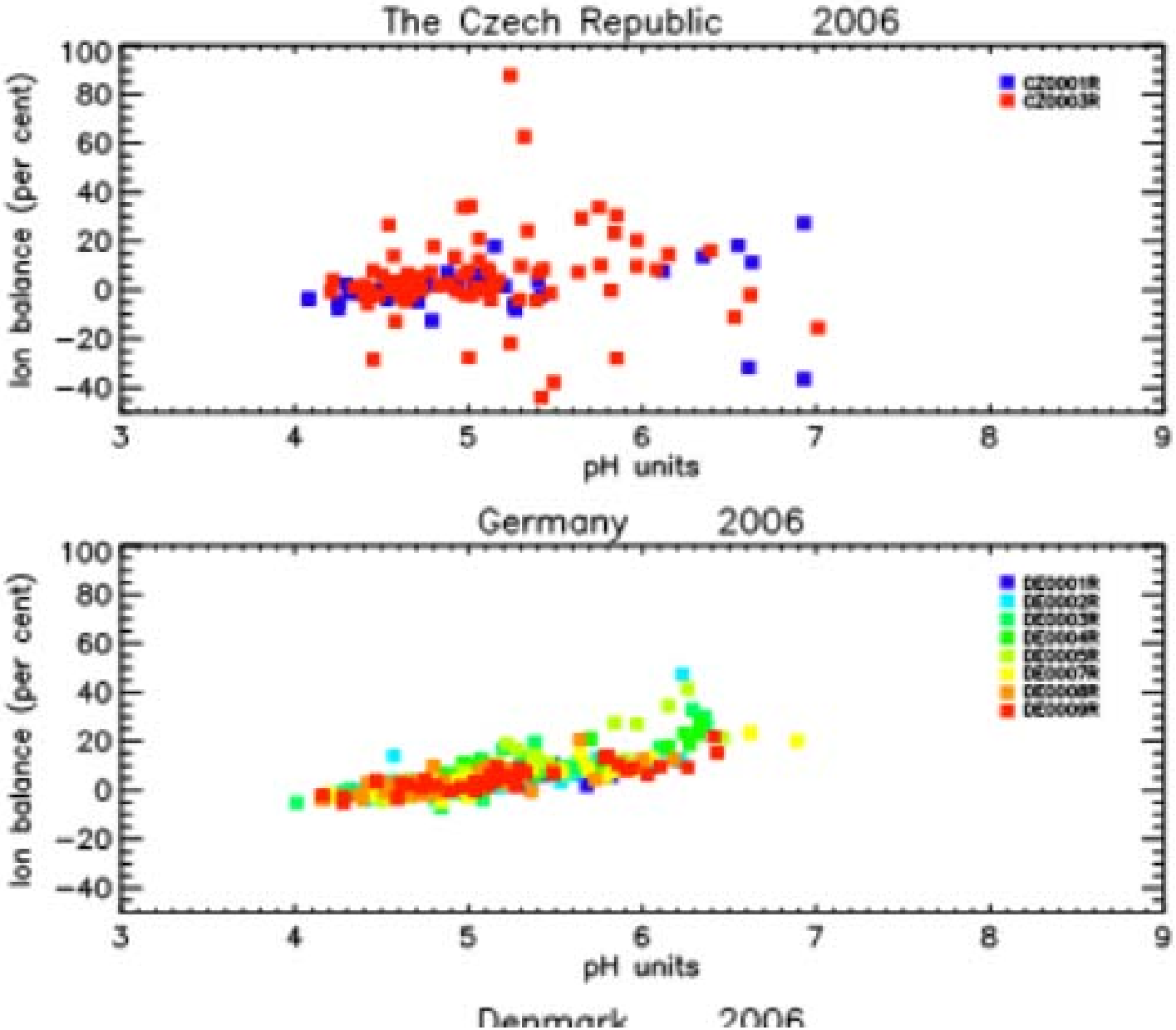


TCM ain Germany (historic data) at DE09 (left and DE03 (right)



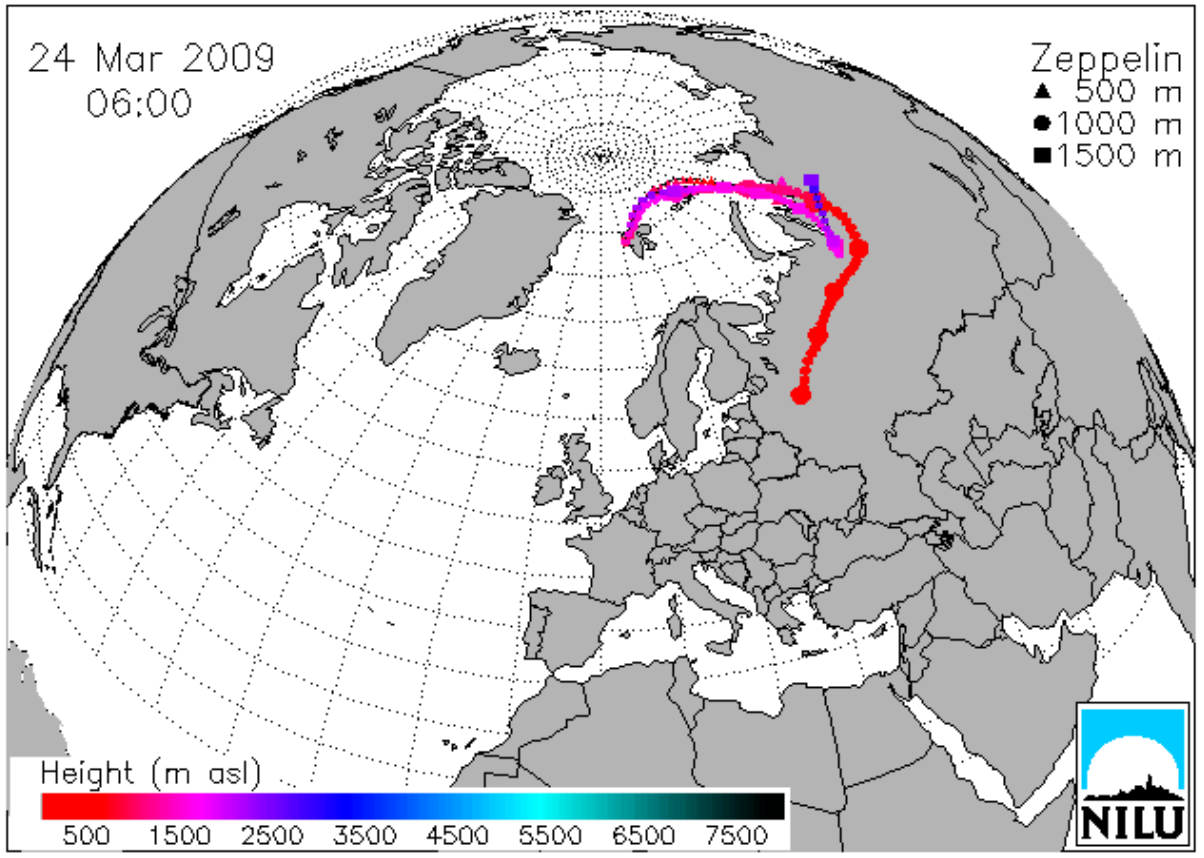


Ion balance plot



Use trajectories to check episodes

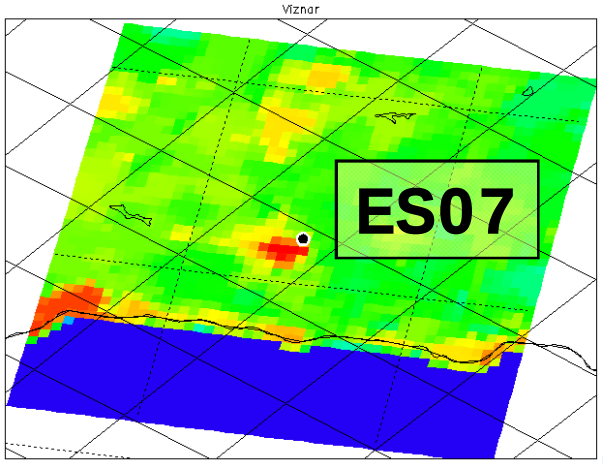
	Date	SO2
9	322	0.067
9	323	0.179
9	324	2.349
9	325	0.940
9	326	0.558
9	327	0.317



OK data.
LRT episode

NILU

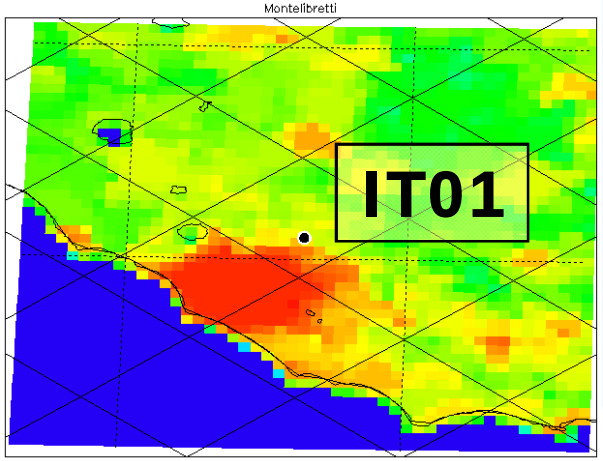
http://www.nilu.no/trajectories/



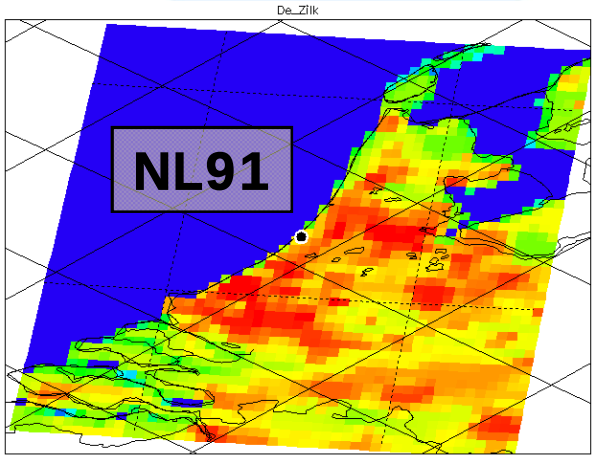
Comparing EMEP model and obs. in light of population density

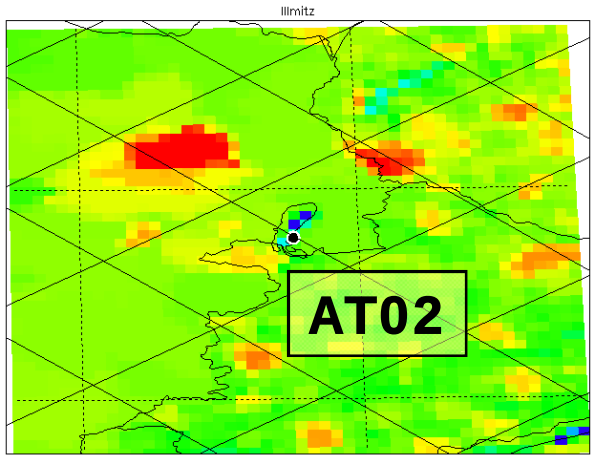
GEOmon
Global Earth Observation and Monitoring

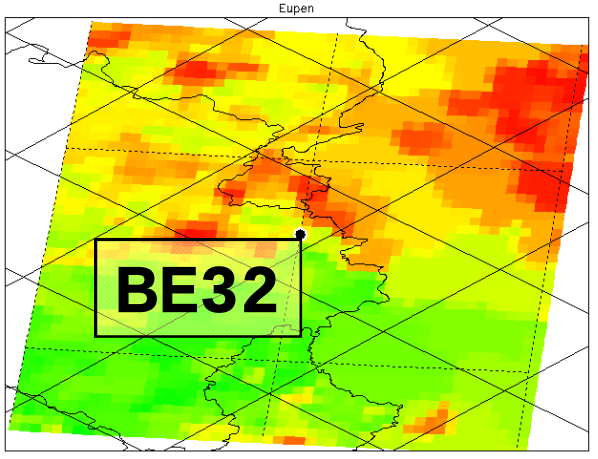
Representativity, NO_2

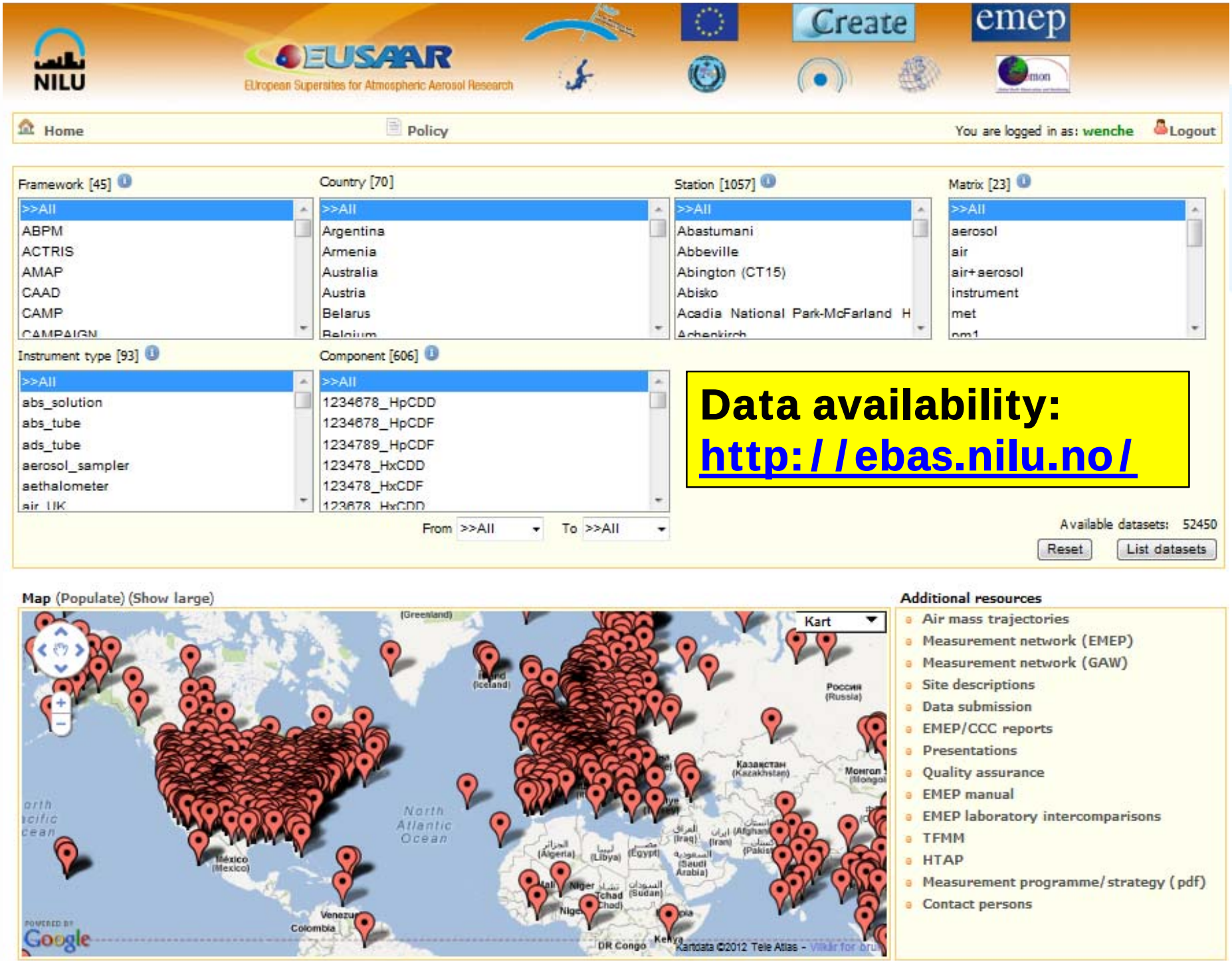


NO2, 1999-2005						
Site	Nr	Obs	Model	Bias	Spread	R^2
AT0002	2345	1.57	2.57	-0.39	1.76	0.57
BE0032	3493	3.33	4.83	-0.31	2.42	0.69
ES0007	3122	0.87	2.73	-0.68	7.71	0.15
IT0001	3300	3.16	4.79	-0.34	2.55	0.22
NL0091	2774	5.84	7.03	-0.17	2.45	0.68





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Thank you for the attention!