EMEP/CCC-Report 6/2005

EMEP Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe

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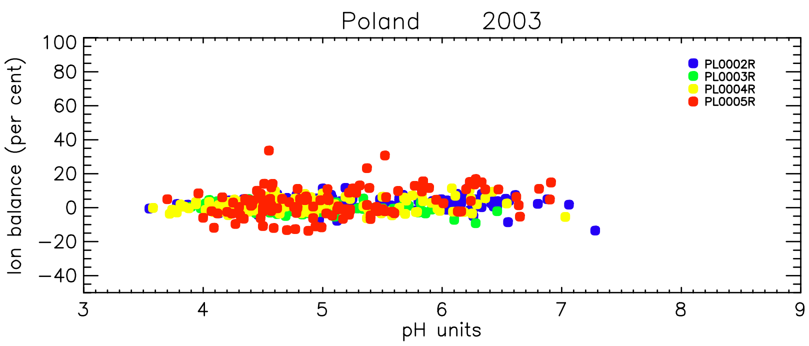

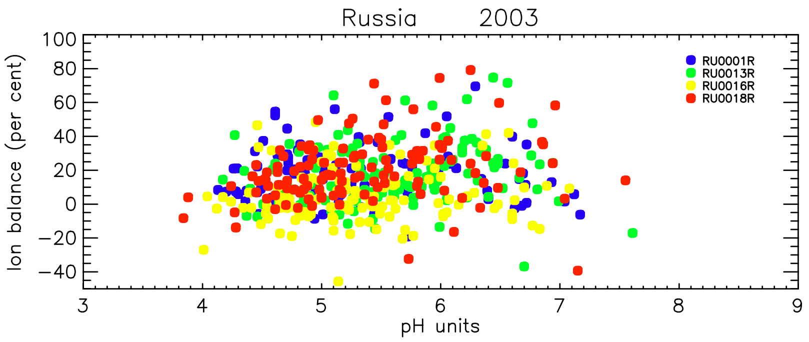

Norwegian Institute for Air Research
PO Box 100, NO-2027 Kjeller, Norway
Chemical Co-ordinating Centre of EMEP (CCC)

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Contents

Summary

This report is mainly concerned with the quality of the 2003 data and new results from field and laboratory comparisons.

The requirement with respect to data completeness for the main components in precipitation, i.e. 90 per cent, is generally met, and only two participants have less than a complete precipitation measurement programme. The situation is less favourable for air components with respect to data completeness. There is a strong need for more sites for nitrogen components in air, and only two countries perform accurate measurements of nitric acid and particulate nitrate, and ammonia and ammonium in particles separately by use of denuder systems.

The ion balance for many countries was within ± 20 per cent, which indicate valid data when pH is less than 5.5 (Annex 4). For higher pH values there is often a systematic difference that is not yet fully understood. However, it should be emphasized that the ion balance does not give an exact assessment of the quality.

Laboratory comparison of the main components in precipitation and air is carried out annually. The main message is that the laboratory performances in general are satisfactory, but that there nevertheless is room for improvements for some components like chloride, magnesium, calcium, and potassium. Laboratory comparison of heavy metals is also performed annually. The measurements of high concentration samples give hardly any problem, but at many EMEP sites these are not very representative. Several countries have problems measuring low concentration samples of Cr, Ni, As and Cd. Field intercomparison of national co-located precipitation sampling is presented. The results are varying quite a lot. A general conclusion is that daily bulk measurements usually are comparable with weekly wet-only. Longer sampling frequency is not recommended, especially not for bulk collectors.

The main components in air and precipitation has been assigned a DQ flag based on results in the laboratory and field intercomparison.

Annex 5 contains detection limits and estimates of precision, both for the complete measurement methods applied, and for the chemical method in the laboratories. This Annex is based on the information and data the participants themselves have forwarded to the CCC.

Data quality 2003, quality assurance, and field comparisons

1. Introduction

The aim of quality assurance is to provide data with sufficiently good and known quality, and this series of reports is intended to document the EMEP data quality and the progress made. The present report is relevant for the 2003 data. All data included in the EMEP program is covered by this data quality report, most of the information available on the data quality is, however, on acidifying and eutrophying components.

Much of the information given here are collected from the participating laboratories, this being data on detection limits and precision, and results from parallel sampling. CCC organizes annually different types of comparisons, and the EMEP Laboratory intercomparison and results from field comparisons with reference instrumentation provide important information of the data quality. Information of both these types of comparisons is used in a new flagging system of data quality.

Calculations of ion balances in precipitation samples are important supplementary information to evaluate the data quality; however, the ion balance (IB) check is mainly a control of the analytical procedure, and contamination or other field problems are not detected by this control. In addition, at high pH and/or at low ion strength the IB test is more uncertain. A flagging system has been developed to fully get use of the information from the ion balance test, however the flags are not implemented to the database yet.

2. Measurement programme and data completeness

EMEP's measurement programme in 2003 is given in Table 1. Details on the sampling program and measurement frequency at the different sites are found in the different data reports (Hjellbrekke, 2005; Hjellbrekke and Solberg, 2005; Aas and Breivik, 2005; Solberg, 2005).

Many Parties do not fulfil the measurement program. There is in general a big lack of measurements of particles, VOC, POPs and heavy metals. The monitoring strategy being developed for 2004–2009 (EB.AIR/GE.1/2004/5) aims to improve this situation and a better spatial coverage is expected in the future.

According to the Data Quality Objectives (DQO) of EMEP (Annex 1), the data completeness should be at least 90 per cent for main ions and heavy metals. In Annex 2 there is a summary of the data capture for all the EMEP data for 2003.

For the precipitation components most participants broadly met the DQO, but the data completeness for the air components is less satisfactory.

Table 1: EMEP's measurement programme 2003.

	Components	Measurement period	Measurement frequency
Gas	SO_2, NO_2	24 hours	Daily
	O_3	Hourly means stored	Continuously
	Light hydrocarbons C_2-C_7	10-15 mins	Twice weekly
	Ketones and aldehydes (VOC)	8 hours	Twice weekly
	Hg	24 hours	Weekly
Particles	SO_4^{2-}, NH_4^+, NO_3^-, Ca^{2+}, Mg^{2+}, Na^+, K^+, Cl^-	24 hours	Daily
	Cd, Pb (first priority), Cu, Zn, As, Cr, Ni (second priority)	Weekly	Weekly
	PM_{10} mass	24 hours	Daily
Gas + particles	HNO_3(g)+NO_3^-(p), NH_3(g)+NH_4^-(p)	24 hours	Daily
	POPs (PAH, PCB, HCB, chlordane, lindane, α-HCH, DDT/DDE)	Daily/weekly	Once weekly
Precipitation	Amount, SO_4^{2-}, NO_3^-, Cl^-, pH, NH_4^+, Na^+, Mg^{2+}, Ca^{2+}, K^+, conductivity	24 hours/weekly	Daily/weekly
	Hg, Cd, Pb (first priority), Cu, Zn, As, Cr, Ni (second priority)	Weekly	Weekly
	POPs (PAH, PCB, HCB, chlordane, lindane, α-HCH, DDT/DDE)	Weekly	Weekly

For heavy metals, VOC and POPs the data capture is lower than for the main components, especially for air samples. The reason is that several countries analyse e.g. one or two air samples weekly. This will give poor data completeness, but the seasonal distribution is anyhow satisfactory, and the annual average will probably give a reasonable estimate even though there are no measurements on the majority of the days.

Even though percentage of measurements above detection limit is not defined in the DQO it is important that most of the data is measurable, otherwise the uncertainty in the average will become quite high. The exact level of what is acceptable depend somewhat on the concentration level and the component in question. In Annex 3 it is given a summary of the number of samples below the detection limit for main components and heavy metals. Limits of 75%, 50% and 25% are given. Heavy metal and POP (not shown) measurements have more problems than the main components, but there are also some things to point out for these, i.e. the SO_2 measurements in France.

3. Ion balances

The ion balance is a good test on consistency and errors in the analytical results, but will not necessarily reveal a contamination of the sample. This will depend on whether or not the contamination occurred before the analysis started. The ion balance will also fail to discover errors related to the precipitation sampling.

The ion balances for all precipitation samples from 2003 are presented in Annex 4, as a function of pH. Ion balances for samples with pH < 5 were, for many countries, better than 15–20%, indicating fairly good accuracy in the determination of the individual ions. Some results give very scattered plot of the ion balance, i.e. in CZ, CS, EE and SK. This may indicate that the quality assurance routines need to be improved.

At some sites there were many samples with pH > 5. This is particularly the case in Mediterranean countries due to alkaline dust as clearly seen from the Portuguese and Spanish results, as well as at other continental sites and in the far north of Europe. It is an experience made that ion balances become markedly poorer with increasing pH above 5–6. Some countries seem to have systematic deficit of anions, i.e. in contrast to the large spread in the ion balances seen in the Mediterranean. This is seen at many sites, e.g. in Switzerland, Latvia and Norway. In other countries, e.g. in Denmark and Poland, the systematic anion deficit does not occur.

The reason for the poor ion balances at pH values above 5–6 is not yet fully understood. One contributing factor is certainly due to unmeasured ion species present in the sample, i.e. organic acids and bicarbonate. Biological degradation of some precipitation components may also contribute. The systematic deficit of anions at pH above 5–6 is a general problem, which also occurs in other networks in other parts of the world. The current situation with the very poor ion balances for samples with pH above 5 is highly unsatisfactory since we will only have limited information about the consistency of these results. Countries having weakly acidic samples as a larger fraction of their precipitation could supplement their current pH measurements with titration for determining weak acid concentrations, preferably as described in the Manual (EMEP/CCC, 1996). Only one site does this today, Kollumerwaard, Netherlands (NL09).

4. Accuracy, detection limits and precision

A request for quality assurance data for the main components was made earlier this year: measurement and laboratory lower detection limit and precision results from control samples, and detection limits and precision for monitors. The information collected on detection limits and precision is given in Annex 5.

There are various ways of defining the measurement and laboratory precision and detection limit. The methods for calculating these data are defined in the EMEP Manual (EMEP/CCC, 1996). To quantify the precision in the measurements, parallel sampling is necessary and the precision should be given as M.MAD and CoV, relative standard deviation (RSD) is also an informative parameter. M.MAD expresses the spread of the data and equals the standard deviation if the population has a normal distribution. CoV expresses the relative spread of the data, and, similar to the M.MAD, approaches the relative standard deviation for a normal distributed population. Both parameters are non-parametric statistics, which make them particularly useful for measurements with spikes in the data. The definitions of M.MAD and CoV are (Sirois and Vet, 1994):

$$M.MAD = \frac{1}{0.6754}\, median\left(\left|e_i - median\left(e_i\right)\right|\right)$$

where e_i is the error in the two measurements

$$CoV \; \frac{M.MAD}{median\left(\overline{C}\right)} * 100\%$$

where $\overline{C}$ is the average of the two corresponding results. If a reference method is used to evaluate the national/local measurements, the median of the reference measurements is used.

The detection limit is calculated using three times the standard deviation of the field blanks and given in the same unit as the measurement data. By using split samples and laboratory blank samples, laboratory precisions and detection limits can be assessed in a similar way.

5. Results from field comparisons

5.1 Main components in air

Since last year QA report (Aas et al., 2004), field intercomparison has been performed in Slovakia, SK02 Stara Lesna. Unfortunately, the experiment failed due to leaking problem in the Slovakian intake. It is therefore necessary to repeat the exercise this year.

5.2 Main components in precipitation

Several sites have national co-located sampling of main ions in precipitation. The difference of the sampling can either be of type (wet only contra bulk) and/or frequency (daily, weekly, biweekly). Here we present results from Košetice (CZ03) and Langenbrügge (DE02) that measure daily bulk and weekly wet only; Eskdalemuir (GB02) that measure daily and biweekly bulk precipitation, and Valencia (IE01) that has compared two different bulk collectors with daily frequency. The measurements are aggregated to monthly averages and the statistical differences are on the arithmetic average of all the monthly data except for IE01 where the daily measurements are used, Table 2. The results are varying quite a lot. For IE there is a problem with large sea salt episodes that is difficult to measure, Figure 1. There are also problems with ammonium measurement at this site; the results are very scattered. For DE02 the two measurements correlate well except for some months were the deviation is quite large, Figure 2. The differences in CZ03 are somewhat larger but also here the correlation is high, Figure 3. In GB02 one can clearly see that the biweekly sampling tends to give higher concentrations due to more influence of dry deposition, Figure 4. At this site there has also been problems with bird droppings. A general conclusion is that daily bulk measurements usually are comparable with weekly wet-only. Longer sampling frequency is not recommended, especially not for bulk collectors.

Table 2: Statistical summery of the co-located precipitation measurements at DE02, CZ03, GB02, IE01.

DE02	mm	NH4	Ca	Cl	Mg	NO3	pH	K	Na	xSO_4	SO_4 tot
WO weekly, ar. mean	56.74	0.71	0.26	0.89	0.08	0.54	4.88	0.06	0.51	0.52	0.57
Bulk daily, ar. mean	53.23	0.69	0.24	0.8	0.07	0.55	4.89	0.08	0.46	0.49	0.53
WO weekly, median	46.46	0.61	0.19	0.63	0.07	0.47	4.79	0.05	0.39	0.49	0.51
Bulk daily, median	40.42	0.59	0.21	0.53	0.06	0.48	4.82	0.07	0.3	0.45	0.49
Num pairs:	36	36	36	36	36	36	36	36	36	36	36
Average diff:	3.51	0.02	0.02	0.08	0.01	-0.01	0	-0.03	0.05	0.03	0.04
Per cent av. diff	6 %	3 %	8 %	9 %	13 %	-2 %	0 %	-50 %	10 %	6 %	7 %
Median diff:	4.64	0.01	0.01	0.04	0.01	0	-0.01	-0.02	0.02	0.02	0.02
M.MAD:	8.49	0.08	0.08	0.13	0.02	0.06	0.12	0.03	0.06	0.05	0.05
Cov:	18 %	13 %	40 %	20 %	26 %	13 %	2 %	54 %	15 %	10 %	10 %

CZ03	mm	NH4	Ca	Cl	Mg	NO3	pH	K	Na	xSO_4	SO_4 tot
WO weekly, ar. mean	52.7	0.63	0.33	0.36	0.06	0.57	4.76	0.09	0.15	0.68	0.7
Bulk daily, ar. mean	52.97	0.68	0.26	0.36	0.05	0.56	4.71	0.11	0.17	0.69	0.7
WO weekly, median	47.97	0.58	0.28	0.26	0.05	0.5	4.7	0.07	0.11	0.6	0.61
Bulk daily, median	48.6	0.61	0.21	0.26	0.04	0.51	4.64	0.08	0.13	0.62	0.62
Num pairs:	96	96	96	96	96	96	96	96	96	96	96
Average diff:	-0.27	-0.05	0.07	0.01	0.01	0.01	0.05	-0.02	-0.02	0	0
Per cent av. diff	-1 %	-8 %	21 %	3 %	17 %	2 %	1 %	-22 %	-13 %	0 %	0 %
Median diff:	-0.06	-0.03	0.03	-0.03	0.01	0	0.04	-0.02	-0.01	-0.01	-0.01
M.MAD:	3.89	0.13	0.09	0.14	0.02	0.09	0.15	0.05	0.05	0.1	0.1
Cov:	8 %	23 %	33 %	53 %	41 %	18 %	3 %	72 %	49 %	17 %	16 %

GB02	mm	NH4	Ca	Cl	Mg	NO3	pH	K	Na	xSO_4	SO_4 tot
daily, ar. mean	126.57	0.26	0.13	2.19	0.14	0.22	4.87	0.09	1.27	0.26	0.37
biweekly, ar. mean	114.64	0.41	0.11	2.42	0.15	0.25	4.9	0.11	1.36	0.33	0.44
daily, median	117.6	0.25	0.1	1.81	0.12	0.22	4.84	0.09	1.04	0.25	0.34
biweekly, mean	94.44	0.29	0.1	2.16	0.13	0.24	4.96	0.08	1.18	0.27	0.4
Num pairs:	24	22	24	24	24	24	22	22	24	24	24
Average diff:	11.93	-0.15	0.02	-0.23	-0.01	-0.03	-0.03	-0.02	-0.09	-0.07	-0.07
Per cent av. diff	9 %	-58 %	15 %	-11 %	-7 %	-14 %	-1 %	-22 %	-7 %	-27 %	-19 %
Median diff:	9.84	-0.03	0.01	-0.13	-0.01	-0.02	-0.01	0.01	-0.07	-0.01	-0.03
M.MAD:	22.08	0.06	0.02	0.57	0.03	0.05	0.13	0.03	0.23	0.05	0.08
Cov:	19 %	23 %	24 %	32 %	27 %	21 %	3 %	34 %	22 %	22 %	22 %

IE01	mm	NH4	Ca	Cl	Mg	NO3	pH	K	Na	SO_4 tot	xSO_4
EMEP ar. daily mean	5.00	0.28	0.79	26.27	1.88	0.15	5.67	1.18	14.64	1.46	0.24
Campaign ar. daily mean	4.61	0.42	0.59	18.15	1.30	0.13	5.62	0.67	10.14	1.08	0.23
EMEP median:	1.90	0.07	0.39	10.14	0.71	0.05	5.70	0.39	5.80	0.72	0.12
Campaign median:	1.30	0.07	0.32	8.92	0.63	0.05	5.68	0.28	4.90	0.64	0.11
Num pairs:	515	289	291	291	291	291	291	290	291	291	291
Average of differenc:	0.38	-0.14	0.19	8.12	0.58	0.02	0.05	0.51	4.51	0.39	0.01
Per cent av. diff	8 %	-50 %	24 %	31 %	31 %	13 %	1 %	43 %	31 %	27 %	4 %
Median diff:	0.1	0	0.04	0.76	0.04	0	0.03	0.08	0.36	0.04	0
M.MAD:	0.59	0.06	0.13	2.05	0.13	0.01	0.22	0.2	1.04	0.15	0.04
Cov:	31 %	85 %	34 %	20 %	19 %	30 %	4 %	50 %	18 %	21 %	30 %

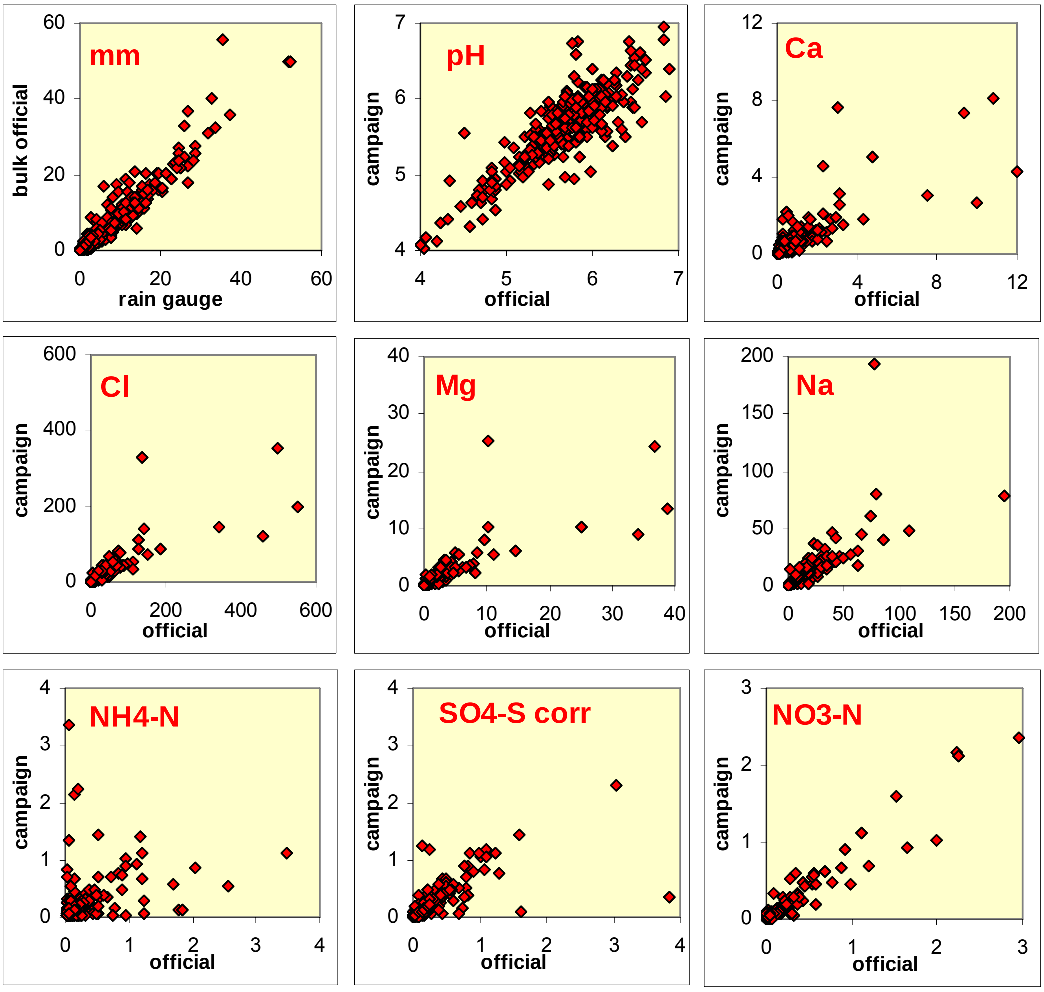


Figure 1: Comparison of two daily bulk collectors at IE01.

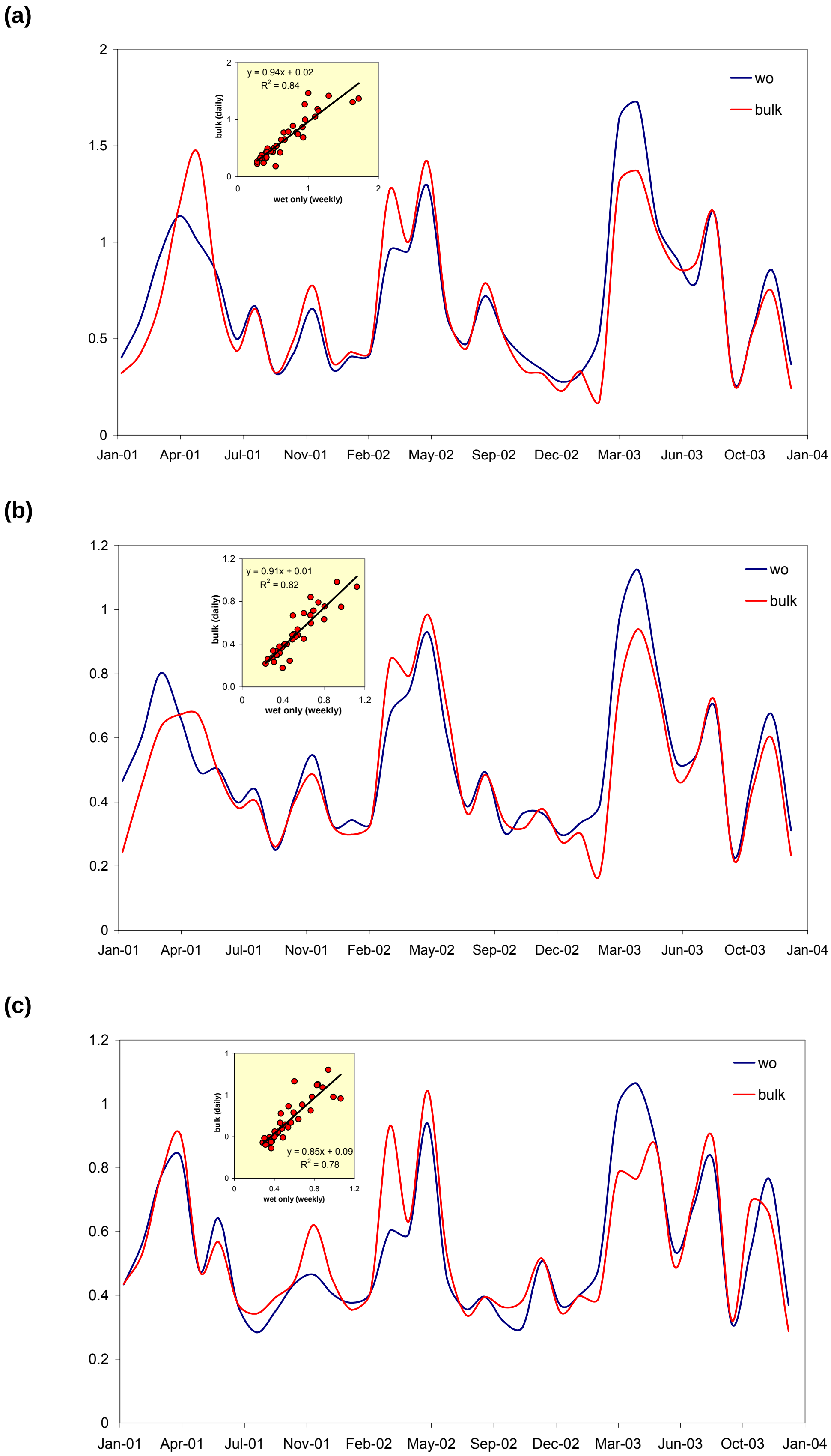
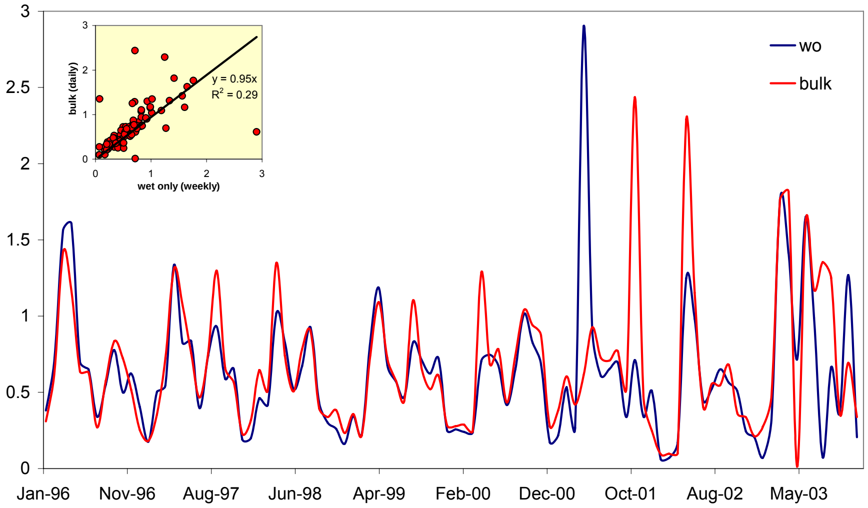
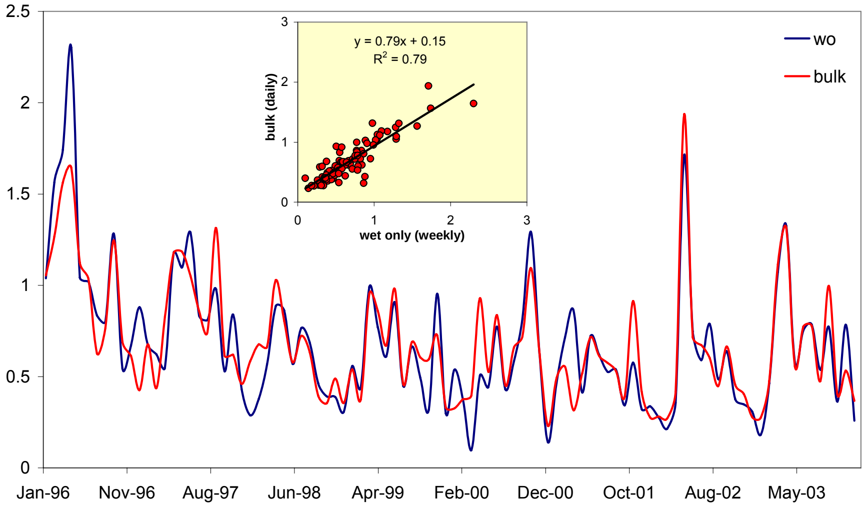


Figure 2: Comparisons of monthly averages of NH_4 (a), SO_4 (b) and NO_3 (c) measured by weekly wet only and daily bulk collector at DE02.

(a)



(b)



(c)

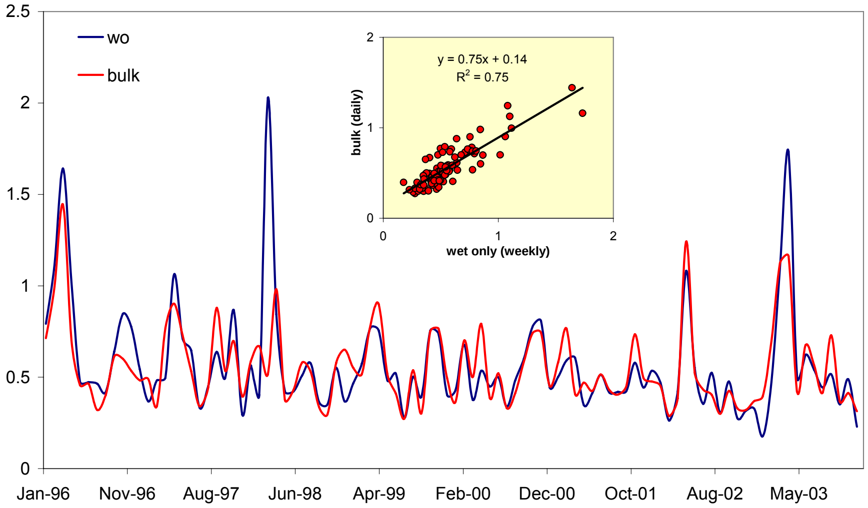


Figure 3: Comparisons of monthly averages of NH_4 (a), SO_4 (b) and NO_3 (c) measured by weekly wet only and daily bulk collector at CZ03.

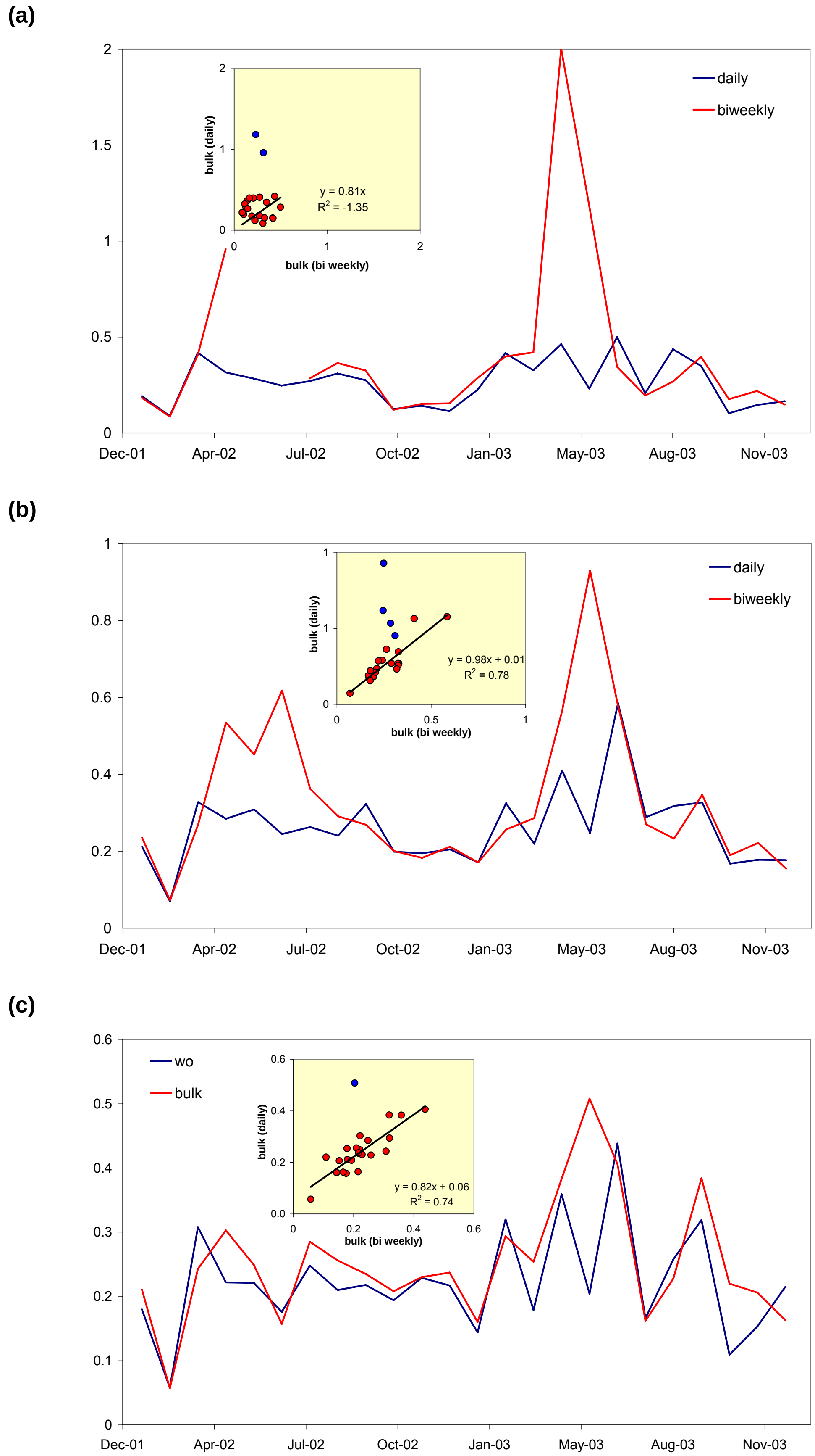


Figure 4: Comparisons of monthly averages of NH_4 (a), SO_4 (b) and NO_3 (c) measured by daily and biweekly bulk collectors at GB02.

6. Results from laboratory comparisons

6.1 Main components

The twenty-first intercomparison (Uggerud et al., 2004) of main components in air and precipitation is relevant for the data reported for 2003. The results of the systematic and random errors are shown in Table 3 and Table 4, respectively. The details on how these calculations are done are presented in Aas et al. (2003). Some of the laboratories presented do not submit data to EMEP. Others submit data but do not participate in the laboratory intercalibration, these latter are marked in grey in Table 3.

The results are mostly good. There are some elements that are more difficult than other and sometimes outliers can cause large deviations, but this is not necessarily the general performance for the laboratory. One should look at the performance for several years if one needs a general picture.

Table 3: Random errors (2RSD%) in the 21st laboratory intercomparison for precipitation and air.

labnr	Country	Precipitation											Air and aerosols			
		SO_4^{2-}-S	NO_3-N	NH_4-N	pH	H	Mg	Na	Cl	Ca	K	Cond	SO_2	NO_2	NH_3-N	HNO_3
1	AT	1.7	1.2	2.2	13.4		7.0	5.2	2.3	4.1	6.1	4.2				
2	BE															
133	BY	16.7	14.4	6.9	11.6		7.0	15.7	57.1	30.5	116.1					
21	CH	1.5	0.7	0.8	4.3		0.4	1.2	0.9	1.1	3.7	1.4				
24	CS	1.4	2.6	5.5	6.6				4.6			9.5				
3	CZ	1.9	1.6	3.2	5.2		0.7	1.4	1.5	3.4	0.4	2.3	3.8	11.3	3.1	2.8
8	DE	1.5	0.8	1.1	4.9		1.5	0.3	0.7	1.1	0.4	1.3	2.0	1.0	2.6	2.1
7	DE(Leip)	1.4	0.6	0.9	5.4		2.2	0.5	2.1	3.9	1.2	4.1				
4	DK	1.7	0.5	0.8	5.1		3.7	1.4	3.1	1.1	2.5	2.2	0.9	2.3	4.2	1.1
38	EE	2.2	1.9	4.4	29.4		1.1	8.4	2.9	5.2	4.6	7.2	16.3	1.0		
19	ES	2.9	0.7	1.8	10.3		0.7	1.2		1.3	0.5	1.2		1.0	0.9	
5	FI	1.4	0.8	1.7	6.7		0.3	0.5	2.1	0.5	3.2	1.3	2.9		8.7	1.0
6	FR	1.3	0.6	1.3	6.2	1.1	1.1	1.6	1.3	1.3	1.1	1.9				
23	GB	1.8	1.0	3.5	4.1		1.5	1.2	7.0	2.8	4.8	1.5		4.5		
35	HR	3.8	0.9	3.0	11.3		6.3	1.2	0.7	8.4	2.1	1.4		0.7		
10	HU	3.0	1.5	2.4	3.5		1.1	2.4	1.6	4.2	5.5	1.6			12.4	
12	IE	1.3	1.7	2.2	5.6		2.6	1.0	1.7	2.3	4.3	1.6		3.6		
11	IS	1.5	2.1		2.4		2.2	0.8	3.3	1.9		4.8	5.3		2.1	
13	IT	3.0	0.9	3.7	7.0		0.7	1.6	1.1	0.9	1.6	1.8			2.1	
30	IT JRC	1.6	0.6	6.1	2.1		6.3	1.6	3.2	2.2	13.2	1.2				
32	LT	3.8	1.0	3.3	7.0			5.3	12.6	18.6	10.0	2.0		2.3	8.1	
33	LV	1.6	0.7	5.5	4.3		3.0	4.9	5.1	9.2	6.1	1.3	4.7	2.7	9.7	4.3
40	MK		10.6	7.7	14.0		5.2	6.9	11.9	2.7	7.7	8.1				
14	NL	2.0	0.9	5.1	6.5	3.9	1.9	4.9	2.6	0.6	5.0	1.8				
15	NO	1.3	1.4	2.9	3.6		3.0	1.9	1.6	2.5	0.5	2.2	7.7	1.1	5.3	2.3
16	PL	2.8	1.1	1.7	3.8		1.5	1.2	7.0	1.1	1.8	1.9	2.7	1.8		1.7
39	PL05	5.1	2.8	2.1	2.4		0.8	0.6	10.4	0.3	0.4	1.7	1.4	1.8	18.2	2.4
17	PT															
22	RU	2.2	1.8	6.5	5.1		5.6	13.2	12.4	23.3	12.7	2.2	2.7	2.2		6.3
18	RO	12.0		64.9	3.7				15.7			6.9				
20	SE	1.0	0.9	2.0	6.2		11.8	1.0	1.7	16.7	6.2	2.0	2.9	4.6	12.0	3.9
36	SI	1.3	1.0	1.7	9.8		1.1	0.6	1.5	0.5	0.7	1.3	3.3	1.1	5.9	1.0
31	SK	1.0	1.0	5.7	3.8		1.5	4.1	1.4	2.5	7.0	1.2	1.9	2.2		2.5
34	TR	1.5	0.7	4.4	6.9		3.7	1.2	3.7	2.0	8.6	6.7	1.4	2.6	18.1	1.4

1-2 DQO   > 2 DQO   not participated

Table 4: Systematic errors (RB%) in the 21st laboratory intercomparison for precipitation and air.

	Precipitation											Air and aerosols			
	SO_4^{2-}-S	NO_3-N	NH_4-N	pH	H	Mg	Na	Cl	Ca	K	Cond.	SO_2-S	HNO_3-N	NO_2-N	NH_3-N
1 AT	0	0	-8 A	-1		0	6	0	5 A	-4	0				
2 BE															
133 BY	24 A	30 A	-16 A	-27 A		-14 A	-23 A	41	-19	21					
21 CH	1	-1	0	-3 A		2 A	-1 A	-1	-1	-4	2 A				
24 CS	-7 A	-7 A	-3 A	-10 A				-10 A			-32 A				
3 CZ	1	-3	2	-9 A		4 A	-9 A	0	2	2 A	2	-9 A	3	0	-7 A
8 DE	2 A	1 A	-2	-7 A		-2 A	-1 A	-1 A	-3 A	-3 A	0	-2 A	2	0	9 A
7 DE (Leip)	1	-1 A	0	-9 A		4 A	1	-3	1	-1	-6 A				
4 DK	2 A	-1 A	-1	-7 A		-14 A	6 A	-5 A	-7 A	-7 A	0	6 A	1	3 A	-4 A
38 EE	7 A	4 A	0	-60 A		-21 A	-14 A	0	-4	2 A	-3	-24		-2 A	
19 ES	-5 A	-4 A	1 A	-36 A		0	-2 A		-2 A	2 A	1			-8 A	-3 A
5 FI	2 A	1 A	-1	1		1 A	1 A	1	1 A	1	-1 A	-1	1		-8 A
6 FR	0	-1	2 A	10 A	16 A	-8 A	-2 A	-6 A	-10 A	2 A	-1				
23 GB	-2	0	4	4		-5 A	-9 A	-17 A	-10 A	-7 A	3 A			-1	
35 HR	3 A	3 A	4	-8 A		5	-3 A	-3 A	2	3 A	0			-4 A	
10 HU	-4	-4 A	-2	1		1	-7 A	-25 A	9 A	-21 A	0				-16 A
12 IE	1 A	4 A	-3 A	6		-4 A	-6 A	0	-9 A	0	6 A			-8 A	
11 IS	-4 A	-6 A		-2		-1	-8 A	-15 A	-2 A		-4 A	-18 A			-1 A
13 IT	4 A	3 A	1	-7		2 A	-1	-1	-2 A	-1	-1				0
30 IT JRC	-2	-6 A	7 A	19 A		-2	-1	-3	-4 A	-6	2				
32 LT	4	0	-4 A	-7			17 A	7	0	16 A	-1			6 A	-1
33 LV	4 A	3 A	8	-2 A		3	-11 A	11 A	0	-11 A	-1	-3 A	4	8 A	9 A
40 MK		14 A	73 A	-56 A		-11 A	-15 A	26 A	-18 A	-32 A	-34 A				
14 NL	6 A	-1	-8	-21 A	2	-1	-4	-5 A	-1	0	2 A				
15 NO	-2 A	-4 A	-3 A	-7 A		1	-1 A	-4 A	5	0	-3	9 A	2	-12 A	-4 A
16 PL	-2 A	-5 A	-3	-9 A		-3 A	-2 A	-10 A	0	-2 A	-7 A	-8 A	2	1	
39 PL05	1	3	-4 A	-2		0	0	-5	1 A	-1	1	-5 A	2	2	-18
17 PT															
18 RO	-28 A		-2	6 A				2			3				
22 RU	-11 A	-8 A	4	-7 A		7 A	21 A	-26 A	16	14	-5 A	-15 A	6	-2 A	
20 SE	0	1 A	3 A	-11 A		35 A	-1 A	-12 A	8	2	1	-10 A	4	1	-10 A
36 SI	0	-1	-1	-1		-1	1 A	-3 A	2 A	-4 A	2 A	-26 A	1	0	-5 A
31 SK	1	1	3 A	-8 A		1	-8 A	1	0	0	6 A	-3	3	-9 A	
34 TR	-1	-3 A	5	-14 A		-1	-6 A	-7 A	-3 A	-14	-3	-5 A	1	-1	-7

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

6.2 Heavy metals

The data quality objectives (DQO) in EMEP states that the accuracy in the laboratory should be better than 15% and 25% for high and low concentrations of heavy metals, respectively (Annex 1). One important measure to check the data quality is the laboratory ring test. There is a marked improvement in the laboratory performance for both lead and cadmium since the beginning of the laboratory comparison in 1995. The intercomparison completed last year is relevant for the 2003 data (Uggerud et al., 2005). In Table 5, there is a summary of the results from this laboratory intercomparison. Sweden and Iceland were not participating because these measurements were analyzed in Norway. The measurements of high concentration samples are generally quite OK, however, at many EMEP sites these high concentrations are not very representative. Several countries have some problems with measuring low concentration samples of Zn, Ni and Cd. In addition, there are some countries reporting measurement data without participating in the laboratory intercomparison: Belgium, Ireland, Portugal, and Spain. Data from these countries are of unknown quality; and it is therefore strongly recommended that they take part in the annual laboratory intercomparison.

Table 5: Average per cent error (absolute) in low and high concentration samples, results from heavy metal laboratory intercomparison in 2003.

	Cr		Ni		Cu		Zn		As		Cd		Pb	
	low	high	low	high	low	high	low	high	low	high	low	high	low	high
AT	1	1	1	2	4	3	2	4	1	4	0	1	0	1
CZ	5	6	46	2	3	1	1	2	7	1	41	3	3	1
DK	13	6	78	7	9	4	0	0	0	5	252	9	28	2
FI	7	5	6	4	16	5	14	15	9	7	8	7	8	14
FR	13	5	0	9	15	7	27	32	7	2	0	0	3	4
DE	0	1	2	3	1	1	4	1	1	1	2	1	3	3
NL	0	5	0	4	0	1	8	5	5	4	2	2	0	2
NO	2	1	2	1	0	1	9	0	5	2	4	0	1	1
PL	0	0	0	0	13	1	2	1	0	0	7	13	5	5
GB	6	9	7	3	6	2	2	5	8	1	13	12	7	4
SK	2	4	49	2	2	1	0	0	11	2	0	1	3	1
LT	1	2	7	1	7	4	62	0	51	19	13	2	10	3
LV	22	10	14	7	12	18	12	1	14	7	0	3	4	3
SI	10	1	78	7	45	4	26	4	3	0	50	3	0	3
EE	0	17	0	1	0	9	0	6	0	23	30	7	3	4
PL05	0	2	0	2	0	2	9	1	0	0	0	6	0	0

1/2 - 1 DQO   1 - 2 DQO   > 2 DQO

7. QA flags for 2003

The data quality (DQ) flag is divided in two two-digit numbers, the leftmost two digits describing the performance in field comparisons and the two rightmost being based on the laboratory comparisons, the definitions are found in Annex 6. The two-digit flags are furthermore defined by letting the first digit represent an estimate of the systematic error and the second digit the random error. Most of the SO_2 and NO_2 in air and SO_4 in aerosols data have been given a four-digit DQ flag. The rest of the air data have not been assigned any flag due to few field- and laboratory comparisons for these components. For precipitation data there has been very few field comparisons and therefore only two flags representing the performance in the laboratory comparisons are given. Details on how these flags are defined are found in Aas et al. (2003).

It should be noted that the field comparisons have been far less both in number and in length with respect to different meteorological situations than desirable, and that the DQ flag cannot be expected to give a precise estimate of the quality. The flags will give a data user a quick overview of the expected errors in a data set and hopefully also give the user reasonable estimates of systematic deviations from a reference and of random errors in the data.

One may also group the different flags in a simpler classification, i.e. A, B, and C or as shown in Table A6.1 and Table A6.2 in three colour codes. The data series flagged with any of the red flags (C) will be classified as invalid data. The rest of the data are classified as valid data although those marked with a green colour (A) is considered by CCC as the most accurate data in the EMEP database. The data user may create other criteria or quality groups depending on the use of the data.

Several countries have never participated in field comparisons, and some countries have changed their measurement method since they took part. The comparisons carried out so far are therefore far from sufficient to express the comparability of all measurements. There are probably many comparisons performed outside EMEP, and if this information is made available, further updates of the flags will be done.

The results obtained in one comparison are used to flag data for all the years this method has been in use at the site. A poor performance in a field comparison can therefore influence the flagging for many years of data. If the data quality is determined to a large extent by the sampling method then this seems to be an acceptable approach. If on the other hand the sampling is fairly simple and the laboratory work determines most of the overall measurement quality, then the performance in the annual laboratory comparisons will more important than the results from a field comparison. Details on the flags for SO_2 and SO_4 in air and CCC's recommendations on whether the field or laboratory flag should be prioritised is shown in Annex 5 in Aas et al. (2004).

In Table 6 and Table 7 the flags relevant for 2003 are listed. The field flags are based on last results in the latest field intercomparison that the country has participated in, while the laboratory flag is based on the results in the 21st laboratory intercomparison (Uggerud et al., 2004). For SO_4 in air, only field flags are shown since this component is taken out from the laboratory intercomparison. SO_4 in precipitation should be representative for the laboratory performance also for SO_4 on filters.

As seen there are very few measurements that should be considered invalid (marked in red); however, the B category is rather big and included measurements with quite high systematic error as well as low precision. It is up to the data user to select which data to be used based on the quality flags depending on the accuracy needed.

Table 6: QA flag and category for main components in precipitation.

Code	pH		SO_4		NH_4		NO_3		Na		Mg		Cl		Ca		K		cond	
AT0002R	00	A	00	A	20	A	00	A	10	A	00	A	00	A	00	A	00	A	00	A
AT0004R	00	A	00	A	20	A	00	A	10	A	00	A	00	A	00	A	00	A	00	A
AT0005R	00	A	00	A	20	A	00	A	10	A	00	A	00	A	00	A	00	A	00	A
CH0002R	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
CH0004R	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
CH0005R	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
CS0005R	40	B	20	A	00	A	20	A	-	-	-	-	40	B	-	-	-	-	60	B
CZ0001R	20	A	00	A	00	A	00	A	20	A	00	A	00	A	00	A	00	A	00	A
CZ0003R	20	A	00	A	00	A	00	A	20	A	00	A	00	A	00	A	00	A	00	A
DE0001R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
DE0002R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
DE0003R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
DE0004R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
DE0005R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
DE0007R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
DE0008R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
DE0009R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
DK0005R	20	A	00	A	00	A	00	A	10	A	40	B	20	A	20	A	20	A	00	A
DK0008R	20	A	00	A	00	A	00	A	10	A	40	B	20	A	20	A	20	A	00	A
DK0022R	20	A	00	A	00	A	00	A	10	A	40	B	20	A	20	A	20	A	00	A
EE0009R	81	C	10	A	00	A	00	A	40	B	60	B	00	A	00	A	00	A	00	A
EE0011R	81	C	10	A	00	A	00	A	40	B	60	B	00	A	00	A	00	A	00	A
ES0007R	60	B	20	A	00	A	00	A	00	A	00	A	-	-	00	A	00	A	00	A
ES0008R	60	B	20	A	00	A	00	A	00	A	00	A	-	-	00	A	00	A	00	A
ES0009R	60	B	20	A	00	A	00	A	00	A	00	A	-	-	00	A	00	A	00	A
ES0011R	60	B	20	A	00	A	00	A	00	A	00	A	-	-	00	A	00	A	00	A
ES0012R	60	B	20	A	00	A	00	A	00	A	00	A	-	-	00	A	00	A	00	A
ES0013R	60	B	20	A	00	A	00	A	00	A	00	A	-	-	00	A	00	A	00	A
ES0014R	60	B	20	A	00	A	00	A	00	A	00	A	-	-	00	A	00	A	00	A
ES0015R	60	B	20	A	00	A	00	A	00	A	00	A	-	-	00	A	00	A	00	A
ES0016R	60	B	20	A	00	A	00	A	00	A	00	A	-	-	00	A	00	A	00	A
FI0004R	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
FI0009R	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
FI0017R	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
FI0022R	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
FR0003R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
FR0005R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
FR0008R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
FR0009R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
FR0010R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
FR0012R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
FR0013R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
FR0014R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
FR0015R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
FR0016R	30	B	00	A	00	A	00	A	00	A	20	A	20	A	20	A	00	A	00	A
GB0002R	00	A	00	A	00	A	00	A	20	A	20	A	40	B	40	B	20	A	00	A
GB0006R	00	A	00	A	00	A	00	A	20	A	20	A	40	B	40	B	20	A	00	A
GB0013R	00	A	00	A	00	A	00	A	20	A	20	A	40	B	40	B	20	A	00	A
GB0014R	00	A	00	A	00	A	00	A	20	A	20	A	40	B	40	B	20	A	00	A
GB0015R	00	A	00	A	00	A	00	A	20	A	20	A	40	B	40	B	20	A	00	A
HU0002R	00	A	00	A	00	A	00	A	20	A	00	A	60	B	10	A	60	B	00	A
IS0002R	00	A	00	A	-		-	-	20	A	-		-		-		-		-	
IT0001R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	0	A	00	A
IT0004R	30	B	00	A	10	A	20	A	00	A	00	A	00	A	00	A	20	A	00	A
LT0015R	20	A	00	A	00	A	00	A	30	B	-		10	A	01	A	30	B	00	A
LV0010R	00	A	00	A	10	A	00	A	40	B	00	A	30	B	00	A	40	B	00	A
LV0016R	00	A	00	A	10	A	00	A	40	B	00	A	30	B	00	A	40	B	00	A
NL0009R	60	B	10	A	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A

Table 6, cont.

Code	pH		SO_4		NH_4		NO_3		Na		Mg		Cl		Ca		K		cond	
NO0001R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
NO0008R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
NO0015R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
NO0039R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
NO0041R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
NO0055R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
NO0099R	20	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
PL0002R	20	A	00	A	00	A	20	A	00	A	00	A	40	B	00	A	00	A	20	A
PL0003R	20	A	00	A	00	A	20	A	00	A	00	A	40	B	00	A	00	A	20	A
PL0004R	20	A	00	A	00	A	20	A	00	A	00	A	40	B	00	A	00	A	20	A
PL0005R	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
RU0001R	20	A	40	B	00	A	20	A	50	B	10	A	60	B	31	B	30	B	00	A
RU0013R	20	A	40	B	00	A	20	A	50	B	10	A	60	B	31	B	30	B	00	A
RU0016R	20	A	40	B	00	A	20	A	50	B	10	A	60	B	31	B	30	B	00	A
RU0018R	20	A	40	B	00	A	20	A	50	B	10	A	60	B	31	B	30	B	00	A
SE0005R	40	B	00	A	00	A	00	A	00	A	50	B	40	B	11	B	00	A	00	A
SE0011R	40	B	00	A	00	A	00	A	00	A	50	B	40	B	11	B	00	A	00	A
SE0014R	40	B	00	A	00	A	00	A	00	A	50	B	40	B	11	B	00	A	00	A
SI0008R	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A	00	A
SK0002R	20	A	00	A	00	A	00	A	20	A	00	A	00	A	00	A	00	A	10	A
SK0004R	20	A	00	A	00	A	00	A	20	A	00	A	00	A	00	A	00	A	10	A
SK0005R	20	A	00	A	00	A	00	A	20	A	00	A	00	A	00	A	00	A	10	A
SK0006R	20	A	00	A	00	A	00	A	20	A	00	A	00	A	00	A	00	A	10	A
SK0007R	20	A	00	A	00	A	00	A	20	A	00	A	00	A	00	A	00	A	10	A
TR0001R	40	B	00	A	00	A	00	A	20	A	00	A	20	A	00	A	40	B	00	A

Table 7: QA flag and category for main components in precipitation.

	SO2			NO2			SO4		SNO3			SNH4		
	qa flag	field	lab	qa flag	field	lab	qa flag	field	qa flag	field	lab	qa flag	field	lab
AT0030R	22 --	B	-	-	-		-	-	-	-		-	-	
CH0001G	3240	B	B	31 --	B	-	-	-	-	-		-	-	
CH0002R	3240	B	B	33 --	B	-	-	-	-	-		-	-	
CH0003R	-	-		33 --	B	-	-	-	-	-		-	-	
CH0004R	3240	B	B	33 --	B	-	-	-	-	-		-	-	
CH0005R	3240	B	B	33 --	B	-	-	-	-- 00	-	A	-- 00	-	A
CS0005R	-	-	-	53 --	B	-	-	-	-	-		-	-	
CZ0001R	1220	B	A	0300	-	A	-	-	-- 00	-	A	-- 20	-	A
CZ0003R	1220	B	A	0300	-	A	-	-	-- 00	-	A	-- 20	-	A
DE0001R	-	-		2300	B	A	-	-	-	-	-	-	-	-
DE0002R	0100	A	A	2300	B	A	-	-	-	-		-	-	
DE0003R	0100	A	A	2300	B	A	00 --	A	-- 00	-	A	-- 10	-	A
DE0004R	0100	A	A	2300	B	A	00 --	A	-- 00	-	A	-- 10	-	A
DE0005R	0100	A	A	2300	B	A	-	-	-	-		-	-	
DE0007R	0100	A	A	2300	B	A	00 --	A	-- 00	-	A	-- 10	-	A
DE0008R	0100	A	A	2300	B	A	-	-	-	-		-	-	
DE0009R	0100	A	A	-	-	-	00 --	A	-	-	-	-	-	-
DE0041R	0100	A	A	-	-		00 --	A	-- 00	-	A	-- 10	-	A
DK0003R	0010	A	A	-	-		00 --	A	-- 00	-	A	-- 00	-	A
DK0005R	0010	A	A	-	-		00 --	A	-- 00	-	A	-- 00	-	A
DK0008R	0010	A	A	0000	A	A	00 --	A	-- 00	-	A	-- 00	-	A
EE0009R	1261	B	B	6200	B	A	-	-	-	-		-	-	
EE0011R	-- 61	-	B	-- 00	-	A	-	-	-	-		-	-	
ES0007R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
ES0008R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
ES0009R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
ES0010R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
ES0011R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
ES0012R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
ES0013R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
ES0014R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
ES0015R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
ES0016R	32 --	B	-	3020	B	A	00--	A	-	-	-	-- 00	-	A
FI0022R	0100	A	A	-	-	-	00--	A	-- 00	-	A	-- 20	-	A
FI0037R	0100	A	A	-	-	-	00--	A	-- 00	-	A	-- 20	-	A
FR0003R	20 --	B	-	-	-		20--	B	-	-		-	-	
FR0005R	20 --	B	-	-	-		20--	B	-	-		-	-	
FR0008R	20 --	B	-	-	-		20--	B	-	-		-	-	
FR0009R	20 --	B	-	-	-		20--	B	-	-		-	-	
FR0010R	20 --	B	-	-	-		20--	B	-	-		-	-	
FR0012R	20 --	B	-	-	-		20--	B	-	-		-	-	
FR0013R	20 --	B	-	-	-		20--	B	-	-		-	-	
FR0014R	20 --	B	-	-	-		20--	B	-	-		-	-	
FR0015R	20 --	B	-	-	-		20--	B	-	-		-	-	
FR0016R	20 --	B	-	-	-		20--	B	-	-		-	-	
GB0002R	10 --	B	-	-	-		00 --	A	-	-		-	-	
GB0006R	10 --	B	-	-	-		00 --	A	-	-		-	-	
GB0007R	-	-		-	-		00 --	A	-	-		-	-	
GB0013R	10--	B	-	-	-		00 --	A	-	-		-	-	
GB0014R	10--	B	-	-	-	-	00 --	A	-	-		-	-	
GB0015R	10--	B	-	-	-		-	-	-	-		-	-	
GB0036R	-	-		5300	B	A	-	-	-	-		-	-	
GB0037R	-	-		5300	B	A	-	-	-	-		-	-	
GB0038R	-	-		5300	B	A	-	-	-	-		-	-	
GB0043R	-	-		5300	B	A	-	-	-	-		-	-	
GB0045R	-	-		5300	B	A	-	-	-	-		-	-	
HU0002R	-	-	-	13--	B	-	-	-	-	-		-	-	
IE0001R	00 --	A	-	5020	B	A	-- --	-	-	-		-	-	
LT0015R	10 --	B	-	3210	B	A	10--	B	10 --	B	-	-- 00	A	A
LV0010R	5000	B	A	0210	B	A	22--	B	1000	B	A	0210	A	A
LV0016R	5000	B	A	0210	B	A	22--	B	1000	B	A	0210	A	A

Table 7, cont.

	SO2			NO2			SO4		SNO3			SNH4		
	qa flag	field	lab	qa flag	field	lab	qa flag	field	qa flag	field	lab	qa flag	field	lab
NL0009R	11 --	B	-	03 --	-	-	00--	A	-	-		-	-	
NL0010R	11 --	B	-	03 --	-	-	00--	A	-	-		-	-	
NO0001R	0010	A	A	0040	A	B	00 --	A	-- 00	-	A	-- 00	-	A
NO0008R	0010	A	A	0040	A	B	00 --	A	-- 00	-	A	-- 00	-	A
NO0015R	0010	A	A	0040	A	B	00 --	A	-- 00	-	A	-- 00	-	A
NO0039R	0010	A	A	0040	A	B	00 --	A	-- 00	-	A	-- 00	-	A
NO0041R	0010	A	A	0040	A	B	00 --	A	-- 00	-	A	-- 00	-	A
NO0042G	0010	A	A	-	-		00 --	A	-- 00	-	A	-- 00	-	A
NO0055R	0010	A	A	0040	A	B	00 --	A	-- 00	-	A	-- 00	-	A
PL0002R	0020	A	A	4300	B	A	01--	A	-- 00	-	A	-	-	-
PL0003R	0020	-	A	4300	B	A	-	-	-- 00	-	A	-	-	-
PL0004R	0020	A	A	4300	B	A	01--	A	-- 00	-	A	-	-	-
PL0005R	2000	B	A	5200	B	A	32--	B	-- 00	-	A	-- 41	-	B
RU0001R	1040	B	B	-	-		00--	A	-	-		-	-	
RU0016R	2340	B	B	-	-		00--	A	-	-		-	-	
RU0018R	2340	B	B	-	-		00--	A	-	-		-	-	
SE0005R	0040	A	B	1000	B	A	00--	A	-- 20	-	A	-- 40	-	B
SE0008R	0040	A	B	1000	B	A	00--	A	-	-		-	-	
SE0011R	0040	A	B	1000	B	A	00--	A	-- 20	-	A	-- 40	-	B
SE0014R	0040	A	B	1000	B	A	00 --	A	-- 20	-	A	-- 40	-	B
SI0008R	0060	A	B	-	-		20--	B	-- 00	-	A	-- 00	-	A
SK0002R	-- 00	-	A	5320	B	A	-- --	-	-	-		-	-	
SK0004R	-- 00	-	A	5320	B	A	-- --	-	-	-		-	-	
SK0005R	-- 00	-	A	5320	B	A	-- --	-	-	-		-	-	
SK0006R	-- 00	-	A	5320	B	A	-- --	-	-	-		-	-	
SK0007R	-- 00	-	A	5320	B	A	-- --	-	-	-		-	-	
TR0001R	0000	A	A	-- 00	-	A	-	-	-- 00	-	A	-- 21	-	B
CS0005R	-	-	-	53 --	B	-	-	-	-	-		-	-	

8. Audits

Audit is not being done regularly from CCC, but will be done when needed. It is recommended regular audits at all EMEP sites, at least as an internal control every year, but also with visitors from e.g. neighbouring countries. Forms to be used for auditing main components in air and precipitation, and ozone can be downloaded from EMEP's homepage, http://www.nilu.no/projects/ccc/qa/index.htm. It is recommended that all the external auditing is reported to CCC.

9. References

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10. List of participating institutions and the national quality assurance managers (NQAM)

Country	**Institute**	**NQAM**
Austria	Umweltbundesamt	Christian Schuetz
Croatia	Meteorological and Hydrological Service of Croatia	Sonja Vidic
The Czech Republic	Czech Hydrometerological Institute	Nadezda Melichova
Denmark	National Environmental Research Institute	Lone Grundahl
Estonia	Estonian Environmental Research Lab. Ltd	Toivo Truuts
Finland	Finnish Meteorological Institute	Veijo Pohjola
France	l'Ecole des Mines de Douai Laboratories Wolff	Patrice Coddeville
Germany	Umweltbundesamt	Markus Wallasch
Greece	Ministry of Environment Physical Planning and Public works	Vasiliki Smirnioudi
Hungary	Hungarian Meteorological Service, Institute for Atmospheric Physics	Laszlo Haszpra
Island	The Icelandic Meteorological office	Johanna Thorlacius
Ireland	Environmental Protection Agency	Concannon Colman
Italy	CNR Instituto Inquinamento Atmosferico	Cinzia Perrino
EU at Ispra, IT04	Joint Research Center (JRC)	Frank Raes and Jean-Philippe Putaud
Latvia	Latvian Hydrometeorological Institute	Iraida Lyulko
Lithuania	Institute of Physics	Dalia Sopauskiene and Vidmantas Ulevicius (HM and POP)
The Netherlands	National Institute for public Helath and Environmental Protection (RIVM)	Arien Stolk
Norway	Norwegian Institute for Air Research (NILU)	Jan Erik Hanssen
Poland	Institute of Meteorology and Water Management and Institute of Environmental Protection	Grazyna Mitosek and for PL05: Anna Degorska
Portugal	Instituto de Meteorologia	Amelia Lopes
Russia	Institute of Global Climate and Ecology	Alexey Ryaboshapko
Serbia and Montenegro	Federal Hydrometeorological Institute	Momcilo Zivkovic
Slovenia	Environment Agency - Slovenia	Brigita Jesenovec
Slovak Republic	Slovak Hydrometeorological Institute	Marta Mitosinkova
Spain	Subdirección General de Calidad Ambiental	Alberto Gonzalez
Sweden	Swedish Environmental Research Institute (IVL)	Karin Sjöberg
Switzerland	Swiss Federal Laboratory of testing Materials and Research (EMPA)	Robert Gehrig/ Claudia Zellweger
Turkey	The Ministry of Health of the Republic of Turkey	Canan Yesilyurt
United Kingdom	AEA Technology	Keith Vincent

Annex 1

Data quality objectives

DQO for the acidifying and eutrophying compounds

- 10% accuracy or better for oxidised sulphur and oxidised nitrogen in single analysis in the laboratory,
- 15 % accuracy or better for other components in the laboratory,
- 0.1 units for pH,
- 15–25% uncertainty for the combined sampling and chemical analysis (components to be specified later),
- 90 % data completeness of the daily values.
- The targets, with respect to accuracy in the laboratory, for the very lowest concentrations of the main components in precipitation follow the WMO GAW (1992) recommendations for regional stations:

	Accuracy	
SO_4^{2-}	0.032 mg S/l	(1 µmol/l)
NO_3^-	0.014 mg N/l	(1 µmol/l)
NH_4^+	0.028 mg N/l	(2 µmol/l)
Cl^-	0.107 mg Cl/l	(3 µmol/l)
Ca^{2+}	0.012 mg Ca/l	(0.3 µmol/l)
K^+	0.012 mg K/l	(0.3 µmol/l)
Mg^{2+}	0.007 mg Mg/l	(0.3 µmol/l)
Na^+	0.007 mg Na/l	(0.3 µmol/l)

The targets for the wet analysis of components extracted from air filters are the same as for precipitation. For SO_2 the limit above for sulphate is valid for the medium volume method with impregnated filter. For NO_2 determined as NO_2^- in solution the accuracy for the lowest concentrations is 0.01 mg N/l.

The aim for data completeness is valid for the current definition used by the CCC. This definition will, however, be harmonised with the WMO GAW definition and modified.

DQO for heavy metals

- 90% completeness
- 30% accuracy in annual average
- Accuracy in laboratory (c= concentration):

Pb:	15%	if c > 1 µg Pb/l
	25%	if c < 1 µg Pb/l
Cd:	15%	if c > 0.5 µg Cd/l
	25%	if c < 0.5 µg Cd/l
Cr:	15%	if c > 1 µg Cr/l
	25%	if c < 1 µg Cr/l
Ni:	15%	if c > 1 µg Ni/l
	25%	if c < 1 µg Ni/l
Cu:	15%	if c > 2 µg Cu/l
	25%	if c < 2 µg Cu/l
Zn:	15%	if c > 10 µg Zn/l
	25%	if c < 10 µg Zn/l
As:	15%	if c > 1 µg As/l
	25%	if c < 1 µg As/l
Hg:	15%	if c > 0.01 µg Hg/l
	25%	if c < 0.01 µg Hg/l

Annex 2

Data capture

Table A2.1: Data capture for main components in precipitation in 2003, in per cent.

Code	mm	mm off	pH	SO4	XSO4	NH4	NO3	Na	Mg	Cl	Ca	K	cond
AT0002R	100	-	100	100	100	100	100	100	100	100	100	97	100
AT0004R	100	-	100	100	100	100	100	100	100	100	100	100	100
AT0005R	100	-	100	100	100	100	100	100	100	100	100	99	100
BE0014R	100	-	-	95	-	95	95	95	95	95	95	42	95
BY0004R	38	-	68	72	66	40	68	44	67	60	69	44	34
CH0002R	100	-	97	95	95	95	95	95	95	95	95	95	97
CH0004R	100	-	100	100	100	100	100	100	100	100	100	100	100
CH0005R	100	-	96	94	94	94	94	94	94	94	94	94	96
CS0005R	100	-	100	100	100	100	100	100	100	100	100	100	100
CZ0001R	100	-	93	91	91	93	91	92	92	91	92	92	92
CZ0003R	100	-	89	89	89	99	89	99	89	89	89	99	88
DE0001R	100	100	99	99	99	99	99	99	99	99	99	99	99
DE0002R	99	-	99	99	99	99	99	99	99	99	99	99	99
DE0003R	95	-	100	100	100	100	100	100	100	100	100	100	100
DE0004R	99	-	100	100	100	100	100	100	100	100	100	100	99
DE0005R	99	-	100	100	100	100	100	100	100	100	100	100	100
DE0007R	95	-	99	99	99	99	99	99	99	99	99	99	99
DE0008R	97	-	100	100	100	100	100	100	100	100	100	100	99
DE0009R	99	100	100	100	100	100	100	100	100	100	100	100	100
DK0005R	100	-	96	96	96	96	96	96	96	96	87	96	96
DK0008R	100	-	100	100	100	100	100	100	72	84	100	100	100
DK0022R	100	-	100	100	100	100	100	100	100	100	100	100	100
EE0009R	100	-	100	93	93	92	93	92	92	93	87	92	100
EE0011R	100	-	67	67	67	63	67	67	67	67	67	67	67
ES0007R	100	-	94	93	93	92	93	92	92	93	92	92	90
ES0008R	97	-	99	99	99	98	99	98	98	99	98	98	99
ES0009R	96	-	95	94	94	94	94	93	93	94	93	93	93
ES0011R	98	-	97	97	97	93	97	97	97	97	97	97	97
ES0012R	98	-	95	95	95	94	95	94	94	95	94	94	95
ES0013R	99	-	99	98	98	98	98	97	97	98	97	97	91
ES0014R	99	-	93	93	93	92	93	91	91	93	91	91	93
ES0015R	98	-	87	87	87	87	87	86	86	87	86	86	87
ES0016R	94	-	97	97	97	96	97	95	95	97	95	95	94
FI0004R	100	-	100	100	100	100	100	100	100	100	100	100	100
FI0005R	100	-	100	100	-	100	100	100	100	100	100	100	100
FI0008R	102	-	82	82	-	82	82	82	82	82	82	82	82
FI0009R	91	-	99	99	99	99	99	99	99	99	99	99	99
FI0017R	100	-	98	98	98	98	98	98	98	98	98	98	98
FI0022R	100	-	98	98	98	98	98	98	98	98	98	98	98
FI0023R	100	-	99	99	-	99	99	99	99	99	99	99	99
FI0053R	100	-	94	94	-	94	94	94	94	-	94	94	94
FR0003R	100	-	91	87	87	87	87	87	87	87	87	87	91
FR0005R	100	-	99	98	98	98	98	98	98	98	98	98	99
FR0008R	100	-	97	97	97	97	97	97	97	97	97	97	97
FR0009R	100	-	98	98	98	98	98	98	98	98	98	98	98
FR0010R	100	-	95	95	95	95	95	95	95	95	95	95	95
FR0012R	100	-	97	97	97	97	97	97	97	97	97	97	97
FR0013R	100	-	91	91	91	91	91	91	91	91	91	91	91
FR0014R	100	-	93	93	93	92	93	93	93	93	93	93	93
FR0015R	100	-	95	95	95	95	95	95	95	95	95	95	95
FR0016R	100	-	94	93	93	93	93	93	93	93	93	93	94
GB0002R	100	-	100	100	100	100	100	100	100	100	100	100	100
GB0006R	100	-	100	100	100	100	100	100	100	100	100	100	100
GB0013R	100	-	100	100	100	100	100	100	100	100	100	100	99
GB0014R	100	-	100	100	100	100	100	100	100	100	100	100	100

Table A2.1, cont.

Code	mm	mm off	pH	SO4	XSO4	NH4	NO3	Na	Mg	Cl	Ca	K	cond
GB0015R	100	-	100	100	100	100	100	100	100	100	100	100	100
GB0017R	100	-	-	-	-	100	100	-	-	-	-	-	-
GB0091R	98	-	-	-	-	100	100	-	-	-	-	-	-
HU0002R	100	100	100	99	99	100	99	100	100	99	100	100	100
IE0001R	100	100	97	97	97	99	97	97	99	97	97	99	97
IS0002R	100	-	100	100	100	-	-	100	-	-	-	-	-
IS0090R	100	100	91	100	100	100	100	100	100	100	100	100	91
IS0091R	100	100	-	-	-	100	100	-	-	-	-	-	-
IT0001R	100	-	100	100	100	100	100	89	100	100	100	94	100
IT0004R	100	-	99	100	100	100	100	100	97	100	100	100	99
LT0015R	100	-	100	100	100	100	100	100	-	100	100	100	100
LV0010R	100	-	96	94	94	96	94	94	94	94	94	94	96
LV0016R	100	-	95	88	88	98	88	90	90	88	90	90	96
NL0009R	100	-	77	76	76	75	76	69	69	76	69	69	70
NL0091R	96	81	-	-	-	92	92	-	-	-	-	-	-
NO0001R	100	-	98	100	100	100	100	100	100	100	100	100	98
NO0008R	93	-	98	99	99	99	99	99	99	99	99	99	98
NO0015R	100	-	96	99	99	98	99	99	99	99	99	98	97
NO0039R	99	-	99	100	100	100	100	100	100	100	100	100	99
NO0041R	99	-	98	100	100	99	99	100	100	100	100	99	99
NO0055R	100	-	89	82	82	98	82	98	98	82	98	97	89
PL0002R	100	-	99	99	99	99	99	99	99	99	99	99	99
PL0003R	100	-	99	99	99	99	99	98	98	99	98	98	99
PL0004R	100	-	98	98	98	98	98	98	98	98	98	98	98
PL0005R	100	100	100	99	99	99	99	98	98	98	98	98	83
PT0001R	-	100	77	77	77	77	77	77	77	77	77	77	77
PT0003R	-	100	94	94	94	94	94	94	94	92	94	94	94
PT0004R	-	100	91	91	91	91	91	91	91	91	91	91	91
PT0010R	-	100	97	97	-	97	97	97	97	97	97	97	97
RU0001R	100	-	100	100	100	100	100	100	100	100	100	100	100
RU0013R	100	-	99	100	100	100	100	100	100	100	100	100	100
RU0016R	100	-	100	100	100	100	100	100	100	100	100	100	100
RU0018R	100	-	99	100	100	100	100	100	100	100	100	100	99
SE0005R	100	-	100	100	100	100	100	100	100	100	100	100	100
SE0011R	100	-	100	100	100	100	100	100	100	100	100	100	100
SE0014R	100	-	100	99	99	99	99	99	99	99	99	99	98
SE0098R	100	-	82	82	-	82	82	82	82	82	82	82	82
SI0008R	100	100	98	99	99	99	99	99	99	99	99	99	98
SK0002R	100	-	79	91	91	91	91	91	91	91	91	91	78
SK0004R	100	-	77	85	85	83	84	86	85	85	86	86	78
SK0005R	100	-	87	93	93	93	93	92	94	93	94	92	87
SK0006R	100	-	77	87	87	86	87	87	87	87	87	87	77
SK0007R	100	-	85	97	97	98	97	98	98	96	97	98	85
TR0001R	71	-	96	100	100	100	100	99	99	100	99	99	98

Table A2.2: Data capture for main components in air in 2003, in per cent.

Code	SO_2	NO_2	SO_4	XSO_4	SNO_3	NO_3	HNO_3	SNH_4	NH_4	NH_3	Na	Mg	Cl	Ca	K
AT0002R	98	97	98	-	-	98	98	-	98	94	-	-	-	-	-
AT0004R	-	96	-	-	-	-	-	-	-	-	-	-	-	-	-
AT0005R	-	93	-	-	-	-	-	-	-	-	-	-	-	-	-
AT0030R	95	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BE0001R	-	90	-	-	-	-	-	-	-	-	-	-	-	-	-
BE0011R	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-
BE0013R	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-
BE0032R	-	94	-	-	-	-	-	-	-	-	-	-	-	-	-
BE0035R	-	73	-	-	-	-	-	-	-	-	-	-	-	-	-
CH0001G	100	78	100	-	-	-	-	-	-	-	-	-	-	-	-
CH0002R	100	100	100	-	-	-	-	-	-	-	-	-	-	-	-
CH0003R	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-
CH0004R	99	99	-	-	-	-	-	-	-	-	-	-	-	-	-
CH0005R	99	82	99	-	97	-	-	97	-	-	-	-	-	-	-
CS0005R	91	88	-	-	-	-	-	-	-	-	-	-	-	-	-
CZ0001R	99	99	-	-	99	-	-	100	-	-	-	-	-	-	-
CZ0003R	99	100	-	-	99	-	-	100	-	-	-	-	-	-	-
DE0001R	-	93	-	-	58	-	-	58	-	-	-	-	-	-	-
DE0002R	99	99	-	-	-	-	-	-	-	-	-	-	-	-	-
DE0003R	98	93	99	-	58	-	-	58	-	-	-	-	-	-	-
DE0004R	99	98	99	-	57	-	-	57	-	-	-	-	-	-	-
DE0005R	90	96	-	-	-	-	-	-	-	-	-	-	-	-	-
DE0007R	92	98	100	-	58	-	-	57	-	-	-	-	-	-	-
DE0008R	100	95	-	-	-	-	-	-	-	-	-	-	-	-	-
DE0009R	99	100	99	-	58	-	-	58	-	-	-	-	-	-	-
DE0041R	84	-	84	-	57	-	-	56	-	-	-	-	-	-	-
DK0003R	95	-	95	95	95	-	-	90	-	-	95	-	-	-	-
DK0005R	98	-	98	97	98	-	-	96	-	-	97	-	-	-	-
DK0008R	100	99	100	99	100	-	-	100	-	-	99	-	-	-	-
DK0011G	28	-	28	-	-	28	-	-	42	-	28	-	-	-	-
EE0009R	96	97	-	-	-	-	-	-	-	-	-	-	-	-	-
EE0011R	98	97	-	-	-	-	-	-	-	-	-	-	-	-	-
ES0007R	98	99	96	-	98	88	-	98	-	-	-	-	-	-	-
ES0008R	94	93	92	-	93	83	-	94	-	-	-	-	-	-	-
ES0009R	96	94	93	-	97	85	-	96	-	-	-	-	-	-	-
ES0010R	96	96	77	-	94	71	-	88	-	-	-	-	-	-	-
ES0011R	97	96	96	-	98	88	-	99	-	-	-	-	-	-	-
ES0012R	97	96	95	-	96	87	-	99	-	-	-	-	-	-	-
ES0013R	96	96	94	-	98	87	-	100	-	-	-	-	-	-	-
ES0014R	97	96	91	-	95	85	-	98	-	-	-	-	-	-	-
ES0015R	98	97	86	-	94	82	-	87	-	-	-	-	-	-	-
ES0016R	94	91	94	-	97	86	-	95	-	-	-	-	-	-	-
FI0009R	-	98	-	-	-	-	-	-	-	-	-	-	-	-	-
FI0017R	-	98	-	-	-	-	-	-	-	-	-	-	-	-	-
FI0022R	99	67	99	-	99	-	-	99	-	-	-	-	-	-	-
FI0037R	97	83	97	-	97	-	-	99	-	-	-	-	-	-	-
FR0003R	10	-	10	-	-	-	-	-	-	-	-	-	-	-	-
FR0005R	32	-	32	-	-	-	-	-	-	-	-	-	-	-	-
FR0008R	100	-	98	-	-	-	-	-	-	-	-	-	-	-	-
FR0009R	100	-	98	-	-	-	-	-	-	-	-	-	-	-	-
FR0010R	96	-	96	-	-	-	-	-	-	-	-	-	-	-	-
FR0012R	91	-	91	-	-	-	-	-	-	-	-	-	-	-	-
FR0013R	98	-	97	-	-	-	-	-	-	-	-	-	-	-	-
FR0014R	95	-	94	-	-	-	-	-	-	-	-	-	-	-	-
FR0015R	99	-	98	-	-	-	-	-	-	-	-	-	-	-	-
FR0016R	94	-	93	-	-	-	-	-	-	-	-	-	-	-	-
GB0002R	96	-	96	-	-	-	-	-	-	-	-	-	-	-	-
GB0006R	69	-	99	-	-	-	-	-	-	-	-	-	-	-	-

Table A2.2, cont.

Code	SO_2	NO_2	SO_4	XSO_4	SNO_3	NO_3	HNO_3	SNH_4	NH_4	NH_3	Na	Mg	Cl	Ca	K
GB0007R	-	-	86	-	-	-	-	-	-	-	-	-	-	-	-
GB0013R	92	-	88	-	-	-	-	-	-	-	-	-	-	-	-
GB0014R	100	20	99	-	-	100	100	-	100	100	-	-	-	-	-
GB0015R	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GB0036R	-	87	-	-	-	-	-	-	-	-	-	-	-	-	-
GB0037R	-	98	-	-	-	-	-	-	-	-	-	-	-	-	-
GB0038R	-	88	-	-	-	-	-	-	-	-	-	-	-	-	-
GB0043R	-	79	-	-	-	-	-	-	-	-	-	-	-	-	-
GB0045R	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-
GR0001R	49	25	-	-	-	-	-	-	-	-	-	-	-	-	-
HU0002R	97	62	97	-	-	97	97	-	97	97	-	-	-	-	-
IE0001R	100	100	100	-	-	-	-	-	-	-	-	-	-	-	-
IS0002R	-	-	96	-	-	-	-	-	-	-	-	-	-	-	-
IS0091R	-	-	100	-	-	100	-	-	-	-	-	-	100	-	
IT0004R	-	-	67	-	-	67	-	-	67	-	-	-	-	-	-
LT0015R	97	97	97	-	98	-	-	98	-	-	-	-	-	-	-
LV0010R	99	99	100	-	100	99	-	99	100	-	-	-	-	-	-
LV0016R	100	99	100	-	100	100	-	100	100	-	-	-	-	-	-
NL0009R	95	98	86	-	-	86	-	-	86	-	-	-	-	45	-
NL0010R	96	98	98	-	-	98	-	-	98	69	-	-	-	-	-
NL0091R	-	97	-	-	-	92	-	-	92	77	-	-	-	-	-
NO0001R	100	98	100	100	98	98	100	100	100	100	100	100	94	100	100
NO0008R	60	60	61	61	58	59	60	60	60	61	61	61	60	60	60
NO0015R	91	92	92	92	87	87	92	89	92	90	92	92	87	92	92
NO0039R	100	100	99	99	95	95	100	99	99	100	100	100	92	100	100
NO0041R	93	98	94	94	91	92	94	88	95	88	95	95	82	95	95
NO0042G	98	-	98	98	76	77	86	86	86	86	99	99	94	99	99
NO0055R	97	100	98	98	93	94	98	98	98	-	99	99	95	99	98
PL0002R	90	97	99	-	99	99	-	96	98	-	-	-	-	-	-
PL0003R	100	100	100	-	100	100	-	100	100	-	-	-	-	-	-
PL0004R	91	97	83	-	100	100	-	69	100	-	-	-	-	-	-
PL0005R	99	100	100	-	100	-	-	100	-	-	-	-	-	-	-
RU0001R	84	-	83	-	-	83	-	-	83	-	-	-	-	-	-
RU0016R	88	-	87	-	-	88	-	-	88	-	-	-	-	-	-
RU0018R	76	-	76	-	-	76	-	-	76	-	-	-	-	-	-
SE0005R	100	97	100	-	100	-	-	100	-	-	-	-	-	-	-
SE0008R	100	100	99	-	-	-	-	-	-	-	-	-	-	-	-
SE0011R	96	96	96	-	96	-	-	96	-	-	-	-	-	-	-
SE0014R	100	100	100	-	100	-	-	100	-	-	-	-	-	-	-
SI0008R	100	-	100	-	100	-	-	100	-	-	-	-	-	-	-
SK0002R	98	98	98	-	-	97	98	-	-	-	-	-	-	-	-
SK0004R	98	100	99	-	-	98	97	-	-	-	-	-	-	-	-
SK0005R	99	99	99	-	-	98	98	-	-	-	-	-	-	-	-
SK0006R	94	98	97	-	-	97	94	-	-	-	-	-	-	-	-
SK0007R	93	99	96	-	-	96	92	-	-	-	-	-	-	-	-
TR0001R	76	76	76	-	76	76	75	76	76	76	-	-	-	-	-

Table A2.3:Data capture for particulate matter in air in 2003, in per cent.

Code	PM_{10}*	PM_{10}-$PM_{2.5}$	$PM_{2.5}$	PM_1	SPM
AT0002R	7*	-	97	73	-
AT0004R	98	-	-	-	-
AT0005R	89	-	-	-	-
BE0005R	7*	-	-	-	-
CH0001G	-	-	-	-	95
CH0002R	99	-	96	-	-
CH0003R	100	-	-	-	-
CH0004R	99	-	98	98	-
CH0005R	100	-	-	-	-
CZ0003R	7*	-	-	-	-
DE0002R	7*	-	98	-	-
DE0003R	95	-	95	-	-
DE0004R	99	-	99	-	-
DE0005R	98	-	-	-	-
DE0007R	100	-	-	-	-
DE0008R	100	-	-	-	-
DE0009R	100	-	-	-	-
DE0041R	96	-	-	-	-
DK0005R	82	-	-	-	-
ES0007R	96	-	96	-	-
ES0008R	88	-	85	-	-
ES0009R	89	-	81	-	-
ES0010R	67	-	71	-	-
ES0011R	91	-	94	-	-
ES0012R	94	-	97	-	-
ES0013R	94	-	90	-	-
ES0014R	90	-	88	-	-
ES0015R	86	-	78	-	-
ES0016R	93	-	94	-	-
FI0017R	7*	-	-	-	-
GB0046R	7*	-	-	-	-
IE0031R	7*	-	-	-	-
IT0001R	94	-	-	-	-
IT0004R	7*	-	67	-	-
IT0008R	7*	-	-	-	-
NL0009R	7*	-	-	-	-
NO0001R	90	86	94	-	-
NO0099R	-	87	87	-	-
PT0001R	7*	-	-	-	-
SE0005R	-	-	-	-	98
SE0008R	-	-	-	-	100
SE0011R	62	-	58	-	96
SE0012R	85	-	86	-	-
SE0014R	-	-	-	-	99
SE0035R	49	-	52	-	-
SI0008R	47	-	-	-	-
SK0002R	-	-	-	-	79
SK0004R	7*	-	-	-	-
SK0005R	79	-	-	-	-
SK0006R	83	-	-	-	-
SK0007R	-	-	-	-	84

*These measurements with 7% capture are from the EC/OC campaign.

Table A2.4: Data capture for heavy metals in precipitation in 2003, in per cent.

Code	Pb	Cd	Zn	Hg	Ni	As	Cu	Co	Cr	Mn	V	Fe
BE0004R	100	100	100	-	-	100	100	-	-	-	-	-
CZ0001R	87	86	-	-	-	-	-	-	-	-	-	-
CZ0003R	98	98	-	-	-	-	-	-	-	-	-	-
DE0001R	99	99	99	100	99	99	99	99	99	99	99	99
DE0002R	97	97	97	100	96	97	96	97	-	97	97	94
DE0003R	100	100	100	-	100	100	93	100	100	100	100	100
DE0004R	100	100	98	-	100	100	97	100	100	100	100	100
DE0008R	96	95	99	-	99	99	99	99	99	99	99	99
DE0009R	96	96	96	100	96	96	92	96	96	96	96	96
DK0008R	100	100	100	-	100	100	100	-	100	-	-	-
DK0020R	100	100	100	-	100	100	100	-	100	-	-	-
DK0022R	100	100	100	-	100	100	100	-	100	-	-	-
DK0031R	100	100	100	-	100	100	100	-	100	-	-	-
EE0009R	100	100	-	-	-	100	100	-	-	-	-	-
EE0012R	100	100	100	-	-	100	100	-	-	-	-	-
FI0008R	100	100	100	-	100	100	100	-	100	100	100	100
FI0009R	100	100	100	-	100	100	100	-	100	100	100	97
FI0017R	100	100	100	-	100	100	100	-	100	100	100	100
FI0022R	100	100	100	-	100	100	100	-	100	100	100	100
FI0036R	100	100	100	-	100	100	100	-	100	100	100	100
FI0053R	100	100	-	-	100	100	100	-	100	100	-	100
FI0092R	100	100	100	-	100	100	100	-	100	100	100	100
FI0093R	100	100	100	-	100	100	100	-	100	100	100	100
FI0096G	-	-	-	100	-	-	-	-	-	-	-	-
GB0017R	100	100	100	-	100	100	100	-	100	-	-	-
GB0091R	97	97	97	-	97	97	97	-	97	-	-	-
IE0002R	59	59	59	59	59	59	59	-	59	59	59	-
IS0090R	100	100	100	-	100	100	100	-	100	100	100	100
IS0091R	100	100	100	-	100	-	100	-	100	100	-	100
LT0015R	82	100	100	-	-	-	100	-	-	-	-	-
LV0010R	99	99	99	-	99	99	99	-	-	99	-	-
LV0016R	100	100	100	-	100	100	100	-	-	100	-	-
NL0009R	100	100	100	-	100	100	100	-	100	-	-	-
NL0091R	100	100	100	99	100	100	100	-	100	-	-	-
NO0001R	100	100	100	-	-	-	-	-	-	-	-	-
NO0039R	99	99	99	-	-	-	-	-	-	-	-	-
NO0041R	98	98	98	-	-	-	-	-	-	-	-	-
NO0047R	99	99	99	-	99	99	99	97	99	-	-	-
NO0055R	99	99	99	-	-	-	-	-	-	-	-	-
NO0056R	98	98	98	-	-	-	-	-	-	-	-	-
NO0099R	94	98	94	71	98	98	98	98	98	98	-	-
PL0004R	100	100	100	-	100	-	100	-	100	-	-	-
PL0005R	96	96	96	-	96	96	95	-	96	-	-	-
PT0003R	93	93	93	-	93	-	93	-	-	93	-	-
PT0004R	91	91	91	-	91	-	91	-	-	91	-	-
PT0010R	97	97	97	-	97	-	97	-	-	97	-	-
SE0005R	-	-	-	100	-	-	-	-	-	-	-	-
SE0011R	-	-	-	100	-	-	-	-	-	-	-	-
SE0014R	-	-	-	100	-	-	-	-	-	-	-	-
SE0051R	100	100	100	-	100	100	100	100	100	-	100	-
SE0097R	100	100	100	-	100	100	100	100	100	97	100	-
SK0002R	95	96	-	-	100	100	100	-	100	86	-	-
SK0004R	96	100	-	-	100	100	100	-	100	100	-	-
SK0005R	100	100	-	-	97	100	100	-	100	100	-	-
SK0006R	100	100	-	-	100	100	100	-	90	100	-	-
SK0007R	100	100	100	-	100	100	100	-	100	95	-	-

Table A2.5: Data capture for heavy metals in air in 2003, in per cent.

Code	Pb	Cd	Zn	Hg	Ni	As	Cu	Co	Cr	Mn	V	Fe
AT0002 PM1	12	12	-	-	12	12	-	-	-	-	-	-
AT0002 PM10	16	16	-	-	16	16	-	-	-	-	-	-
AT0002 PM25	13	13	-	-	13	13	-	-	-	-	-	-
AT0004R	16	-	-	-	-	-	-	-	-	-	-	-
AT0005R	14	14	-	-	-	-	-	-	-	-	-	-
BE0004R	100	100	100	-	100	-	100	-	-	-	-	-
CZ0001R	22	22	-	-	-	-	-	-	-	-	-	-
CZ0003R	19	19	-	-	-	-	-	-	-	-	-	-
DE0001R	100	97	-	-	100	100	100	-	-	100	-	100
DE0002R	100	100	-	-	97	98	100	-	-	100	-	100
DE0003R	100	-	-	-	91	-	100	-	-	100	-	100
DE0004R	100	97	-	-	100	100	100	-	-	100	-	100
DE0007R	100	100	-	-	97	-	97	-	-	100	-	100
DE0008R	100	100	-	-	100	100	100	-	-	100	-	100
DE0009R	100	100	-	-	100	100	100	-	-	100	-	100
DK0003R	97	97	98	-	97	97	97	-	97	97	-	97
DK0005R	98	98	-	-	98	98	-	-	-	98	-	98
DK0008R	100	100	100	-	100	100	100	-	100	100	-	100
DK0011G	41	-	41	40	41	41	41	-	41	41	-	-
DK0031R	84	84	84	-	84	84	84	-	83	84	-	84
ES0008R	98	98	-	-	-	-	98	-	-	-	-	-
ES0009R	98	98	-	-	-	-	98	-	-	-	-	-
FI0036R	77	77	77	-	77	77	73	-	77	77	77	77
FI0096 tub. denuder	-	-	-	64	-	-	-	-	-	-	-	-
FI0096 amalgan tube	-	-	-	21	-	-	-	-	-	-	-	-
GB0017R	25	25	25	-	25	25	25	-	25	-	-	-
GB0091R	78	78	78	-	78	78	78	-	78	-	-	-
IE0031R	-	-	-	82	-	-	-	-	-	-	-	-
IS0091R	100	100	100	100	100	100	100	-	100	100	100	100
LT0015R	100	100	100	-	-	-	100	-	-	-	-	-
LV0010R	100	96	100	-	100	-	-	-	-	100	-	-
LV0016R	100	100	100	-	100	-	100	-	-	100	-	-
NL0009R	49	49	49	-	-	49	-	-	-	-	-	-
NO0042G	28	28	28	-	28	28	28	28	28	28	28	-
NO0042 monitor	-	-	-	79	-	-	-	-	-	-	-	-
NO0042 high vol sampl	-	-	-	85	-	-	-	-	-	-	-	-
NO0099 $PM_{2.5}$	94	93	94	-	96	95	96	96	96	-	96	-
NO0099 PM_{10}-$PM_{2.5}$	95	93	95	-	95	93	95	95	95	-	95	-
NO0099R	-	-	-	3	-	-	-	-	-	-	-	-
SE0014R	97	97	-	-	97	97	-	-	-	-	-	-
SE0014 tub. denuder	-	-	-	27	-	-	-	-	-	-	-	-
SE0014 amalgan tube	-	-	-	27	-	-	-	-	-	-	-	-
SI0008R	54	56	-	-	56	56	56	-	56	-	-	-
SK0002R	75	79	78	-	78	79	78	-	71	78	-	-
SK0004R	73	75	73	-	75	75	75	-	72	74	-	-
SK0005R	75	78	73	-	79	79	79	-	79	78	-	-
SK0006R	79	79	84	-	84	84	84	-	84	82	-	-
SK0007R	81	84	81	-	84	84	82	-	84	82	-	-

Table A2.6: Data capture for ozone in 2003, in per cent.

Code	O_3	Code	O_3	Code	O_3	Code	O_3	Code	O_3
AT0002R	94	CZ0001R	81	ES0011R	97	GB0033R	99	NO0052R	100
AT0004R	94	CZ0003R	83	ES0012R	97	GB0034R	89	NO0055R	100
AT0005R	96	DE0001R	93	ES0013R	96	GB0035R	99	NO0056R	99
AT0030R	96	DE0002R	96	ES0014R	97	GB0036R	96	NO0488R	76
AT0032R	97	DE0003R	94	ES0015R	97	GB0037R	98	NO0489R	53
AT0033R	91	DE0004R	96	ES0016R	92	GB0038R	96	NO0492R	86
AT0034G	94	DE0005R	73	FI0009R	92	GB0039R	92	PL0002R	100
AT0037R	94	DE0007R	90	FI0017R	98	GB0043R	89	PL0003R	100
AT0038R	94	DE0008R	94	FI0022R	97	GB0044R	97	PL0004R	100
AT0040R	95	DE0009R	96	FI0037R	92	GB0045R	99	PL0005R	98
AT0041R	97	DE0012R	92	FR0008R	97	GR0001R	72	PT0004R	89
AT0042R	96	DE0026R	95	FR0008R	96	GR0002R	60	RU0016R	49
AT0043R	95	DE0035R	91	FR0008R	99	HU0002R	84	RU0018R	98
AT0044R	92	DE0039R	91	FR0008R	99	IE0031R	97	SE0011R	98
AT0045R	95	DE0042R	96	FR0009R	99	IT0001R	98	SE0012R	96
AT0046R	96	DE0045R	91	FR0010R	98	LT0015R	95	SE0013R	100
AT0047R	87	DE0046R	95	FR0012R	87	LV0010R	93	SE0014R	99
AT0048R	95	DE0047R	93	FR0013R	97	MT0001R	80	SE0032R	100
BE0001R	89	DK0005R	100	FR0014R	96	NL0009R	99	SE0035R	98
BE0011R	100	DK0011G	49	FR0015R	97	NL0010R	99	SE0039R	100
BE0013R	100	DK0031R	58	FR0016R	97	NO0001R	99	SI0008R	92
BE0032R	91	DK0041R	97	GB0002R	96	NO0015R	90	SI0031R	94
BE0035R	92	EE0009R	97	GB0006R	73	NO0039R	100	SI0032R	97
BG0053R	50	EE0011R	93	GB0013R	99	NO0041R	97	SI0033R	89
CH0002R	95	ES0007R	97	GB0014R	99	NO0042G	98	SK0002R	59
CH0003R	95	ES0008R	92	GB0015R	87	NO0043R	99	SK0004R	96
CH0004R	95	ES0009R	95	GB0031R	99	NO0045R	33	SK0006R	99
CH0005R	95	ES0010R	95	GB0032R	99	NO0048R	33	SK0007R	99

Table A2.7: The number of samples of hydrocarbons (HC) and carbonyls (Carb) in 2003.

Station	Number of samples HC	Carb
Pallas	94	-
Utö	98	97
Zingst	100	104
Waldhof	100	103
Schmücke	98	103
Brotjacklriegel	102	104
Hohenpeissenberg[1)]	329	-
Košetice	104	102
Starina	87	-
Rigi[1)]	287	-
Donon	101	47
Peyrusse Vieille	86	45
La Tardiere	101	47
Campisábalos	97	-

[1)] Refer to days with monitoring data

Table A2.8: Data capture for POPs in 2003, in per cent.

	precip	precip + dry dep	air	sampl frequenzy
BE0004R	97			
CZ0003R	86		14	1 day a week
DE0001R	100			
DE0009R	100			
FI0096R		23	23	1 week a month
IE0002R	53			
IS0091R	100		100	biweekly
NL0091R	100			
NO0042G			29	2 days a week
NO0099R	99		13	1 day a week
SE0012R		23	23	1 week a month
SE0014R		92	95	weekly

Annex 3

Below detection limit

Table A3.1: Number of samples below the detection limit for main components in precipitation in 2003, in per cent.

Code	pH	SO_4	XSO_4	NH_4	NO_3	Na	Mg	Cl	Ca	K	cond
AT0002R	0	0	0	0	0	4	0	3	0	4	0
AT0004R	0	0	0	0	0	4	8	1	0	20	0
AT0005R	0	0	0	0	0	12	4	2	1	23	0
BE0014R		0		0	0	0	3	0	0	28	0
BY0004R	0	0	0	0	0	0	0	0	0	0	0
CH0002R	0	0	0	0	0	17	0	0	13	11	0
CH0004R	0	0	0	0	0	7	0	0	20	0	0
CH0005R	0	0	0	0	0	19	1	0	15	6	0
CS0005R	0	0	0	0	0	0	0	0	0	0	0
CZ0001R	0	0	0	12	13	0	3	0	0	9	0
CZ0003R	0	3	3	3	0	0	0	0	0	0	0
DE0001R	0	0	0	0	0	0	0	0	0	0	0
DE0002R	0	0	0	0	0	0	0	0	0	0	0
DE0004R	0	0	0	0	0	0	0	0	0	0	0
DE0003R	0	0	0	0	0	0	0	0	0	0	0
DE0005R	0	0	0	0	0	0	0	0	0	0	0
DE0007R	0	0	0	0	0	0	0	0	0	0	0
DE0008R	0	0	0	0	0	0	0	0	0	0	0
DE0009R	0	0	0	0	0	0	0	0	0	0	0
DK0005R	0	0	0	0	0	0	0	0	0	0	0
DK0008R	0	0	0	0	0	0	0	0	0	0	0
DK0022R	0	0	0	0	0	0	0	0	0	0	0
EE0009R	0	0	0	11	0	0	5	0	3	5	0
EE0011R	0	0	0	10	10	0	0	0	0	3	0
ES0007R	0	0	0	35	0	6	0	0	0	4	0
ES0008R	0	0	0	8	0	0	0	0	0	0	0
ES0009R	0	0	0	31	0	6	3	0	0	9	4
ES0011R	0	0	0	49	1	4	0	0	0	1	0
ES0012R	0	0	0	28	0	0	0	0	0	5	0
ES0013R	0	0	0	43	0	4	0	0	0	7	7
ES0014R	0	0	0	10	0	0	0	0	0	0	0
ES0015R	0	0	0	2	0	2	0	0	0	0	0
ES0016R	0	0	0	10	0	0	0	0	0	0	1
FI0004R	0	0	0	0	0	0	4	0	0	0	0
FI0005R	0	0		0	0	0	0	0	0	0	0
FI0008R	0	0		0	0	0	0	0	0	0	0
FI0009R	0	0	0	0	0	0	0	0	0	0	0
FI0017R	0	0	0	2	0	0	0	0	0	0	0
FI0022R	0	2	2	1	0	1	1	0	1	6	0
FI0023R	0	0		0	0	0	0	0	0	0	0
FI0053R	0	0		3	0	0	0		0	0	0
FR0003R	0	0	0	2	0	0	2	0	0	14	0
FR0005R	0	0	0	0	0	0	0	0	0	0	0
FR0008R	0	0	0	1	0	5	41	10	6	31	0
FR0009R	0	0	0	0	0	2	21	2	0	20	0
FR0010R	0	0	0	3	0	2	28	5	3	14	0
FR0012R	0	1	1	7	1	9	27	11	1	31	0
FR0013R	0	0	0	2	0	2	16	1	1	17	0
FR0014R	0	0	0	0	0	10	31	13	1	35	0
FR0015R	0	0	0	1	0	1	6	1	1	12	0
FR0016R	0	0	0	24	0	25	39	25	3	29	0
GB0002R	0	0	0	3	1	0	1	0	3	7	14
GB0006R	0	0	0	17	17	0	4	0	0	0	13
GB0013R	0	0	0	6	0	0	0	0	0	0	0
GB0014R	0	0	0	0	0	0	0	0	0	0	0
GB0015R	0	0	0	33	8	0	0	0	0	8	4
GB0017R				0	0						
GB0091R				0	0						
HU0002R	0	0	0	4	0	0	0	0	0	6	0
IE0001R	0	0	0	27	5	0	4	0	3	4	0
IE0002R											
IS0002R	0	3	3			0					
IS0090R	0	0	0	0	2	0	0	0	0	0	0
IS0091R				41	25						

Table A3.1, cont.

Code	pH	SO_4	XSO_4	NH_4	NO_3	Na	Mg	Cl	Ca	K	cond
IT0001R	0	0	0	0	0	0	0	0	0	0	0
IT0004R	0	0	0	0	0	0	0	0	0	0	0
LT0015R	0	0	0	0	0	0		0	0	0	0
LV0010R	0	0	0	1	0	0	0	0	0	1	0
LV0016R	0	0	0	1	0	1	0	0	0	2	0
NL0009R	0	0	0	0	0	0	0	0	0	0	0
NL0091R				0	0						
NO0001R	0	0	0	6	5	0	1	1	2	4	0
NO0008R	0	1	1	1	1	0	2	1	0	0	0
NO0015R	0	0	0	3	11	0	2	0	0	2	0
NO0039R	0	1	1	9	9	0	1	0	2	4	0
NO0041R	0	0	0	0	6	0	13	3	0	1	0
NO0047R	0	0	0	0	0	0	0	0	0	0	0
NO0048R	0	0	0	0	0	0	7	0	0	7	0
NO0055R	0	0	0	4	4	0	1	0	6	0	0
NO0056R	0	0	0	0	0	0	0	0	0	0	0
NO0057R	0	0	0	14	0	0	0	0	0	0	0
NO0092R	0	0	0	0	23	0	0	0	0	0	0
NO0099R	0	0	0	4	1	0	0	0	0	0	0
NO0218R	0	0	0	1	4	1	11	2	0	4	0
NO0236R	0	0	0	2	11	0	0	2	0	9	0
NO0237R	0	2	2	0	14	0	5	0	0	5	0
NO0478R	0	0	0	0	12	0	0	0	0	0	0
NO0554R	0	0	0	4	6	0	2	0	5	4	0
NO0572R	0	0	0	0	2	0	0	0	0	0	0
NO0655R	0	0	0	0	2	0	2	2	0	4	0
NO0797R	0	0	0	0	0	0	0	0	0	17	0
NO0798R	0	0	0	0	0	0	0	0	0	0	0
NO0917R	0	0	0	2	6	0	0	0	0	0	0
NO1218R	0	0	0	0	26	0	0	0	0	0	0
NO1241R	0	0	0	4	0	0	0	2	0	2	0
PL0002R	0	0	0	0	0	0	0	0	0	0	0
PL0003R	0	0	0	0	0	0	0	0	0	0	0
PL0004R	0	0	0	0	0	0	0	0	0	0	0
PL0005R	0	0	0	2	0	0	0	0	0	0	0
PT0001R	0	10	10	19	17	14	7	2	19	52	0
PT0003R	0	0	0	32	11	0	0	0	4	34	0
PT0004R	0	0	0	36	14	0	0	0	6	22	0
PT0010R	0	0		38	0	0	0	0	0	22	0
RU0001R	0	0	0	0	0	0	0	0	0	0	0
RU0013R	0	0	0	0	0	0	0	0	0	0	0
RU0016R	0	0	0	0	0	0	0	0	0	0	0
RU0018R	0	0	0	0	0	0	0	0	0	0	0
SE0005R	0	0	0	7	0	67	14	11	19	74	0
SE0011R	0	0	0	0	0	13	2	0	2	41	0
SE0014R	0	0	0	2	0	6	0	0	4	23	0
SE0098R	0	0		0	0	0	0	0	0	0	0
SI0008R	0	0	0	0	0	3	7	1	1	27	0
SK0002R	0	0	0	0	0	0	5	0	0	0	0
SK0004R	0	0	0	0	0	0	0	0	0	0	0
SK0005R	0	0	0	0	0	2	0	0	0	0	0
SK0006R	0	0	0	0	0	1	5	0	0	0	0
SK0007R	0	0	0	0	0	1	0	1	0	1	0
TR0001R	0	0	0	0	0	0	0	0	0	0	0

between 25% and 50% below the detection limit

between 50% and 75% below the detection limit

more than 75% below the detection limit

Table A3.2: Number of samples below the detection limit for main components in air in 2003, in per cent.

Code	SO_2	NO_2	SO_4	SNO_3	NO_3	HNO_3	SNH_4	NH_4	NH_3	Na	Ca	Mg	K	Cl
AT0002R	0	0	0		0	0		0	0					
AT0004R		0												
AT0005R		0												
AT0030R	0													
BE0001R		0												
BE0011R	0	0												
BE0013R	0	0												
BE0032R		0												
BE0035R		0												
CH0001G	0	0	11											
CH0002R	0	0	0											
CH0003R		0												
CH0004R	0	0												
CH0005R	0	0	0	0			0							
CS0005R	0	0												
CZ0001R	0	11		0			0							
CZ0003R	0	2		0			0							
DE0001R		0		0			0							
DE0002R	0	0												
DE0003R	0	0	1	8			16							
DE0004R	0	0	0	1			2							
DE0005R	0	0												
DE0007R	0	0	0	3			3							
DE0008R	0	0												
DE0009R	0	0	0	0			0							
DE0041R	0		0	1			1							
DK0003R	0		0	0			0			0				
DK0005R	0		0	0			0			0				
DK0008R	0	0	0	0			0			0				
DK0011G	0		0		0			12		0				
EE0009R	1	0												
EE0011R	2	0												
ES0007R	0	0	0	0	0		0							
ES0008R	0	0	0	0	0		1							
ES0009R	0	0	0	0	0		0							
ES0010R	0	0	0	0	0		0							
ES0011R	0	0	0	1	0		2							
ES0012R	0	0	0	0	0		0							
ES0013R	0	0	0	0	0		0							
ES0014R	0	0	0	0	0		0							
ES0015R	0	0	0	1	0		4							
ES0016R	0	0	0	1	0		0							
FI0009R		0												
FI0017R		0												
FI0022R	4	0	0	1			1							
FI0037R	1	0	0	0			0							
FR0003R	54		0											
FR0005R	44		0											
FR0008R	43		2											
FR0009R	37		0											
FR0010R	68		1											
FR0012R	65		4											
FR0013R	60		1											
FR0014R	74		1											
FR0015R	57		0											
FR0016R	90		6											
GB0002R	0		0											
GB0006R	17		0											
GB0007R			0											
GB0013R	0		0											
GB0014R	0	0	0		0	0		0	0					
GB0015R	0													
GB0036R		0												
GB0037R		0												
GB0038R		0												

Table A3.9, cont.

Code	SO_2	NO_2	SO_4	SNO_3	NO_3	HNO_3	SNH_4	NH_4	NH_3	Na	Ca	Mg	K	Cl
GB0043R		0												
GB0045R		0												
GR0001R	0	0												
HU0002R	0	0	0		1	0		0	5					
IE0001R	2	4	0											
IS0002R			0											
IS0091R			0		0									
IT0004R			0		0			0						0
LT0015R	0	0	0	0			0							
LV0010R	1	2	1	0	2		0	5						
LV0016R	2	6	3	0	2		0	3						
NL0009R	0	0	0		0			0			0			
NL0010R	0	0	0		0			0	0					
NL0091R		0			35			0	0					
NO0001R	2	1	0	1	2	39	0	18	2	2	13	21	8	35
NO0008R	9	4	0	0	4	48	0	31	0	3	5	21	3	25
NO0015R	3	8	0	1	10	71	0	23	0	4	11	27	27	26
NO0039R	4	4	1	1	10	71	0	21	0	2	27	40	30	40
NO0041R	5	1	1	0	6	51	0	14	3	7	21	57	14	60
NO0042G	0		3	0	32	88	0	36	1	4	10	25	46	20
NO0055R	3	8	1	1	13	72	21	21		5	19	32	31	32
PL0002R	6	0	2	0	0		0	0						
PL0003R	0	0	8	0	0		0	2						
PL0004R	4	0	1	0	0		1	1						
PL0005R	0	0	0	1			1							
RU0001R	0		0		0			0						
RU0016R	0		0		0			0						
RU0018R	0		0		0			0						
SE0005R	64	73	5	8			26							
SE0008R	3	1	1											
SE0011R	8	0	5	1			1							
SE0014R	3	0	1	1			2							
SI0008R	0		0	0			0							
SK0002R	0	15	4		50	0								
SK0004R	0	0	0		15	0								
SK0005R	0	1	0		1	0								
SK0006R	0	4	1		10	0								
SK0007R	0	0	0		0	0								
TR0001R	2	0	1	0	17	20	0	4	19					

between 25% and 50% below the detection limit

between 50% and 75% below the detection limit

more than 75% below the detection limit

Table A3.3: Number of samples below the detection limit for heavy metals in precipitation in 2003, in per cent.

Code	Pb	Cd	Zn	Hg	Ni	As	Cu	Co	Cr	Mn	V	Fe
BE0004R	0	58	0			100	83					
CZ0001R	21	0										
CZ0003R	7	0										
DE0001R	0	0	0	0	0	0	0	0	0	0	0	0
DE0002R	0	0	0	0	0	0	0	0		0	0	0
DE0003R	0	0	0		0	0	0	0	0	0	0	0
DE0004R	0	0	0		0	0	0	0	0	0	0	0
DE0008R	0	0	0		0	0	0	0	0	0	0	0
DE0009R	0	0	0	0	0	0	0	0	0	0	0	0
DK0008R	0	0	0		0	0	0		0			
DK0020R	0	0	0		0	0	0		0			
DK0022R	0	0	0		0	0	0		0			
DK0031R	0	0	0		0	0	0		0			
EE0009R	75	8				58	25					
EE0011R	75	0	25			58	0					
FI0008R	0	0	0		0	0	0		0	0	0	0
FI0009R	0	0	0		0	0	0		0	0	0	0
FI0017R	0	0	0		0	0	0		0	0	0	0
FI0022R	0	0	0		0	0	0		8	0	0	0
FI0036R	0	0	0		0	0	0		8	0	0	8
FI0053R	0	0			0	0	0		0	0		0
FI0092R	0	0	0		0	0	0		0	0	0	0
FI0093R	0	0	0		0	0	0		8	0	0	0
FI0096G				0								
GB0017R	0	0	0		0	0	0		0			
GB0091R	0	3	0		0	0	0		0			
IE0001R	100	100	0	100	100	100	100		100	0	100	
IE0002R	75	100	13	100	100	100	50		100	13	100	
IS0090R	0	60	0		2	23	0		10	0	0	6
IS0091R	0	24	0		4		0		5	0		0
LT0015R	0	0	0				0					
LV0010R	3	0	54		46	73	0			76		
LV0016R	11	9	61		33	72	0			61		
NL0009R	0	18	0		55	27	0		73			
NL0091R	0	9	0	0	55	36	0		82			
NO0001R	0	44	0									
NO0039R	10	59	20									
NO0041R	0	38	0									
NO0047R	0	33	0		4	11	0	24	52			
NO0055R	9	65	0									
NO0056R	0	33	0									
NO0099R	0	42	0	0	17	2	0	50	48	6		
PL0004R	0	0	0		0		0		0			
PL0005R	0	4	0		4	0	0		0			
PT0003R	99	100	0		82		59			84		
PT0004R	100	100	0		56		64			83		
PT0010R	75	100	0		16		63			63		
SE0005R				0								
SE0011R				0								
SE0014R				0								
SE0051R	0	0	0		17	0	0	8	42		0	
SE0097R	0	0	0		8	38	0	54	69	0	0	
SK0002R	0	0			0	8	0		0	0		
SK0004R	0	0			0	17	0		8	0		
SK0005R	0	0			0	0	0		0	0		
SK0006R	0	0			17	8	0		0	0		
SK0007R	0	9	27		0	18	0		0	0		

between 25% and 50% below the detection limit

between 50% and 75% below the detection limit

more than 75% below the detection limit

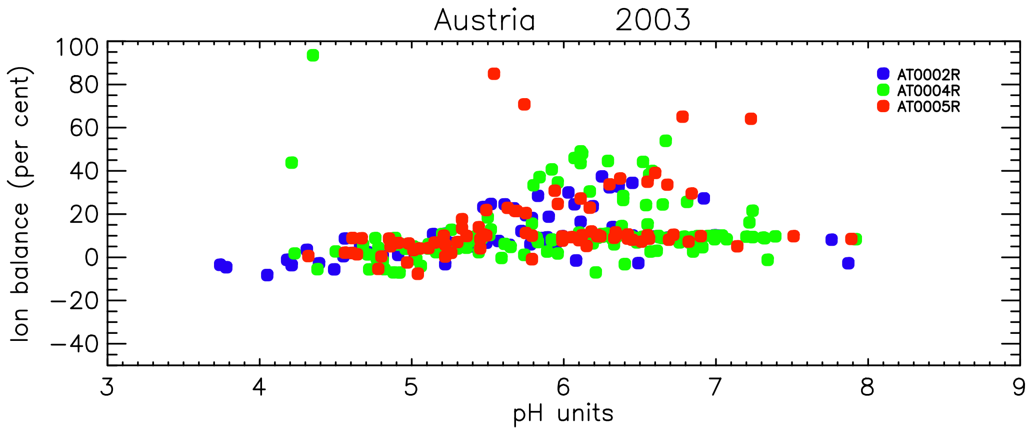
Table A3.4: Number of samples below the detection limit for heavy metals in air in 2003, in per cent.

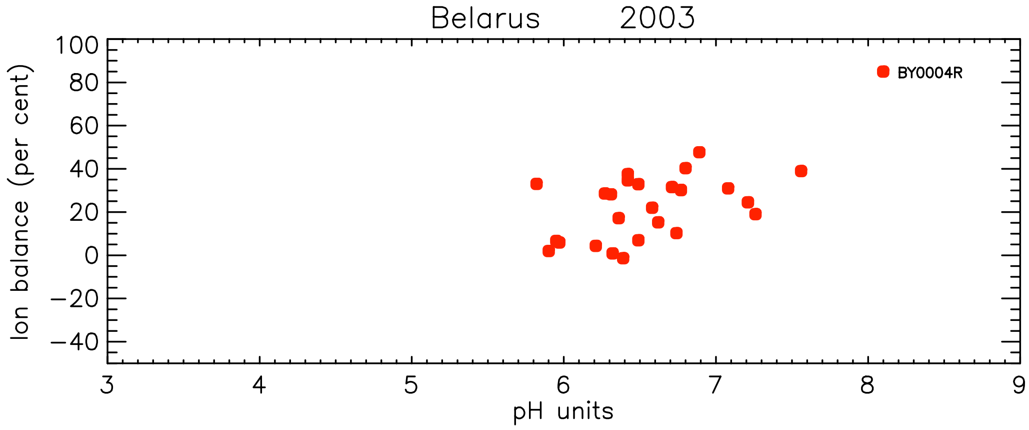
Code	Pb	Cd	Zn	Hg	Ni	As	Cu	Co	Cr	Mn	V	Fe
AT0002 PM_1	2	34			75	70						
AT0002 PM_{10}	0	7			25	45						
AT0002 $PM_{2.5}$	0	13			49	64						
AT0004R	0											
AT0005R	13	40										
BE0004R	0	100	0		33		67					
CZ0001R	0	0										
CZ0003R	0	0										
DE0001R	0	0			0	0	0			0		0
DE0002R	0	0			0	0	0			0		0
DE0003R	0				0		0			0		0
DE0004R	0	0			0	0	0			0		0
DE0007R	0	0			0		0			0		0
DE0008R	0	0			0	0	0			0		0
DE0009R	0	0			0	0	0			0		0
DK0003R	1	83	2		5	3	5		56	2		1
DK0005R	2	82			3	12				8		1
DK0008R	4	90	4		4	10	10		65	7		0
DK0011G	0		0	0	8	12	0		20	0		
DK0031R	7	94	8		10	20	20		69	11		1
ES0008R	0	16					0					
ES0009R	9	26					0					
FI0036R	0	0	0		0	2	0		10	0	0	0
FI0096G				0								
FI0096 tub. denuder				0								
FI0096 amalgan tube				0								
GB0017R	0	0	0		0	0	0		0			
GB0091R	0	0	0		0	0	0		0			
IE0031R				0								
IS0091R	0	0	0	0	0	0	0		0	0	0	0
LT0015R	0	0	0				0					
LV0010R	0	2	2		9					4		
LV0016R	2	2	2		19		6			2		
NL0009R	0	19	34			12						
NO0042G	6	44	54	0	35	25	35	31	85	23	0	
NO0042 monitor				0								
NO0042 high vol sampl				0								
NO0099R				0								
NO0099 $PM_{2.5}$	0	15	17		29	13	24	59	61		18	
NO0099 PM_{10}-$PM_{2.5}$	27	54	45		49	33	31	51	80		2	
SE0014R	0	2			2	2						
SE0014 tub. denuder				0								
SE0014 amalgan tube				0								
SI0008R	43	34			0	52	3		0			
SK0002R	0	8	50		19	39	8		0	0		
SK0004R	0	4	2		2	0	0		2	0		
SK0005R	0	0	0		0	0	0		4	0		
SK0006R	0	0	0		0	0	0		2	0		
SK0007R	0	0	0		0	0	0		0	0		

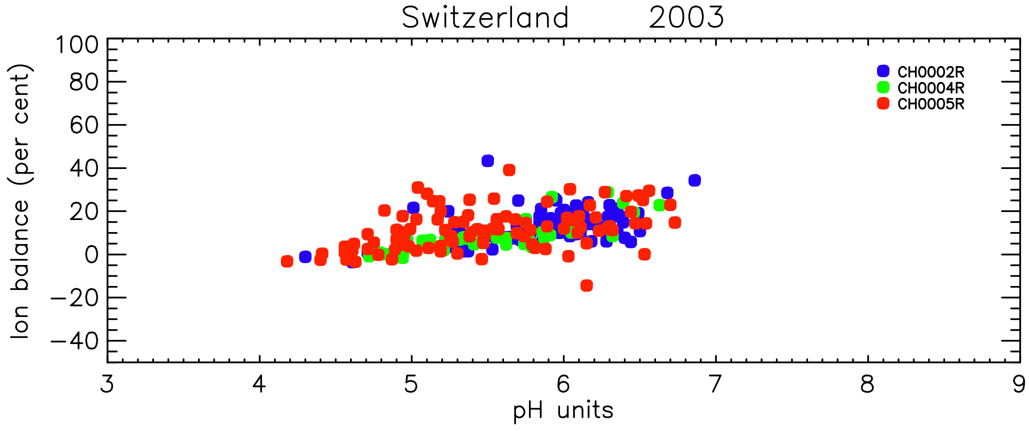
- between 25% and 50% below the detection limit
- between 50% and 75% below the detection limit
- more than 75% below the detection limit

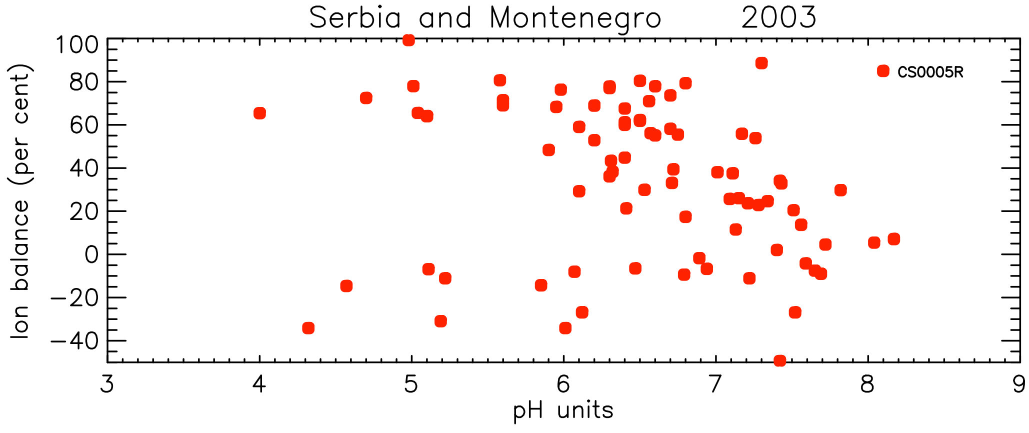
Annex 4

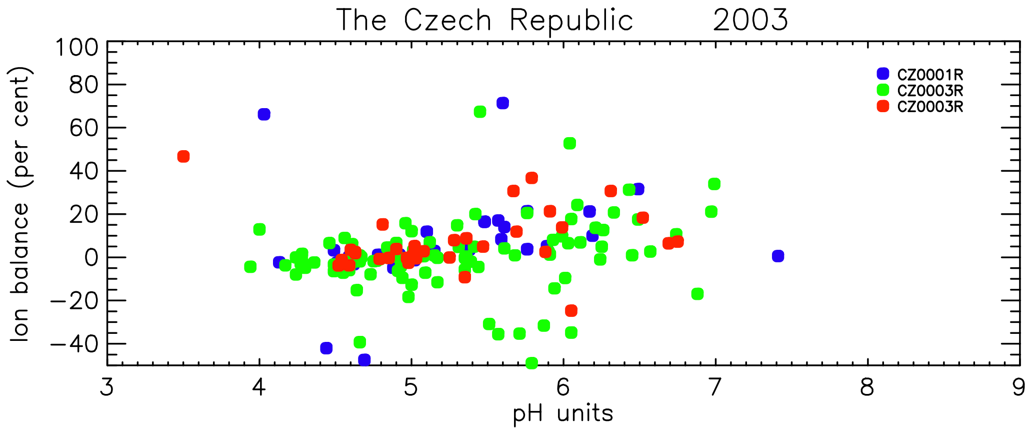
Ion balances in precipitation samples 2003

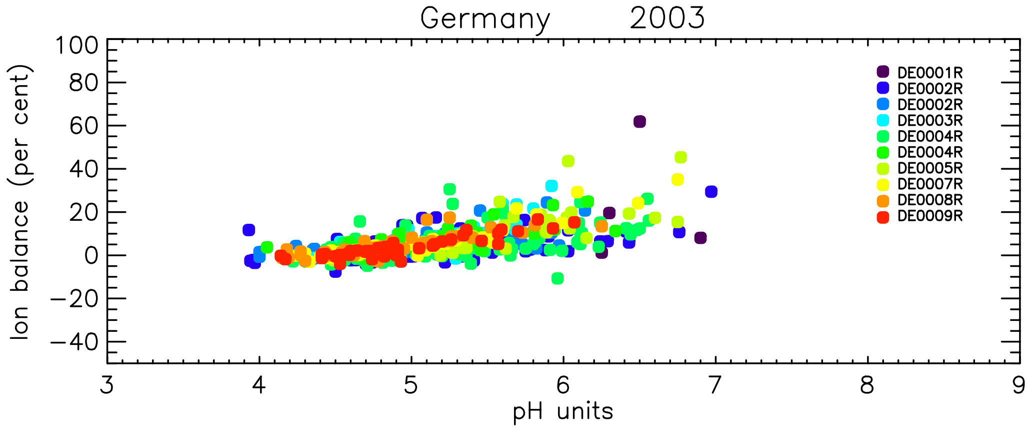

Austria 2003
AT0002R
AT0004R
AT0005R
Ion balance (per cent)
pH units

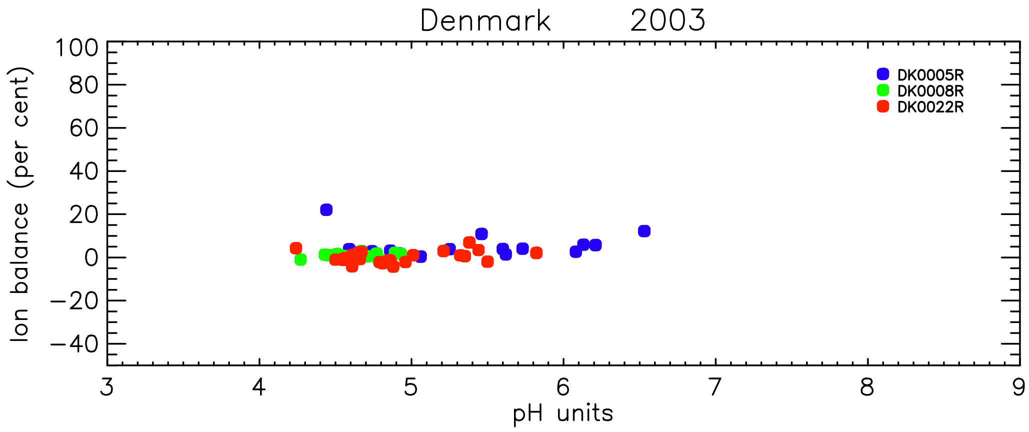

Belarus 2003
BY0004R
Ion balance (per cent)
pH units

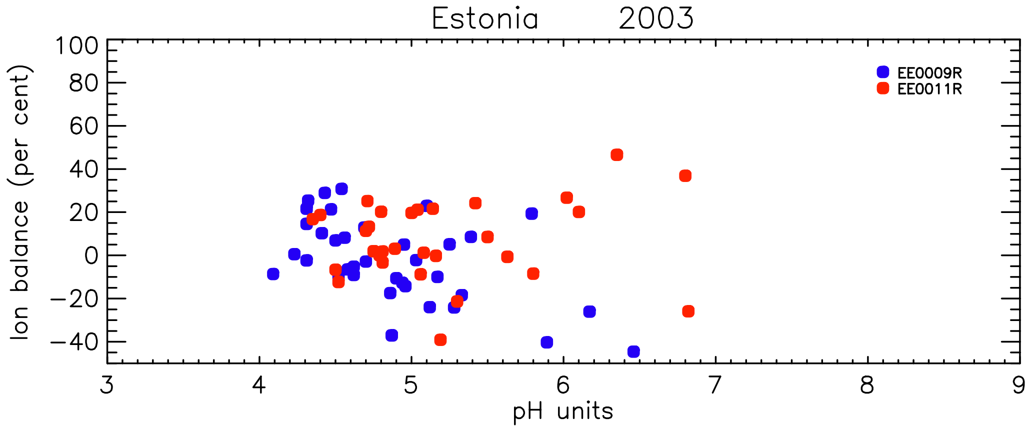

Switzerland 2003
CH0002R
CH0004R
CH0005R
Ion balance (per cent)
pH units

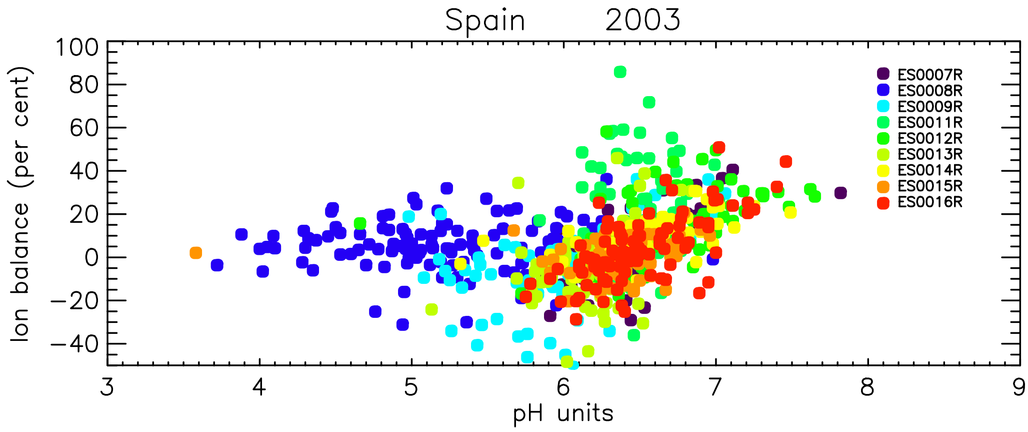

Serbia and Montenegro 2003
CS0005R
Ion balance (per cent)
pH units

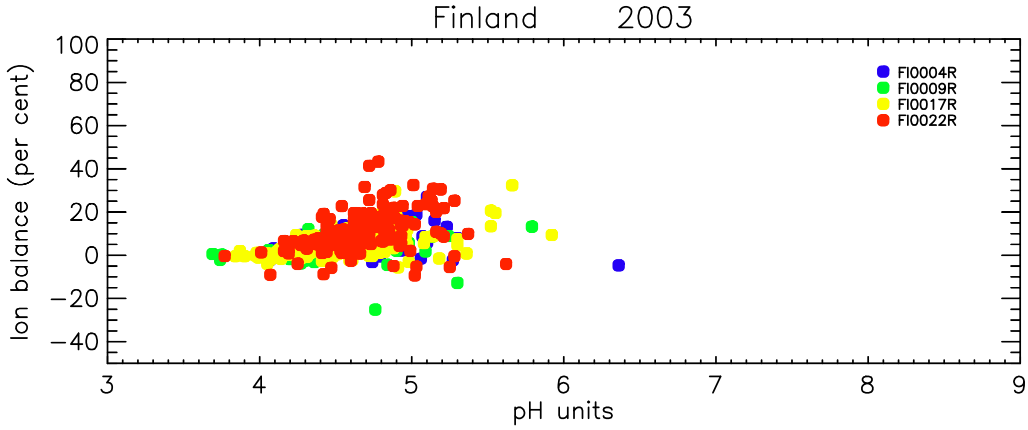

The Czech Republic 2003
Ion balance (per cent)
pH units
CZ0001R
CZ0003R
CZ0003R

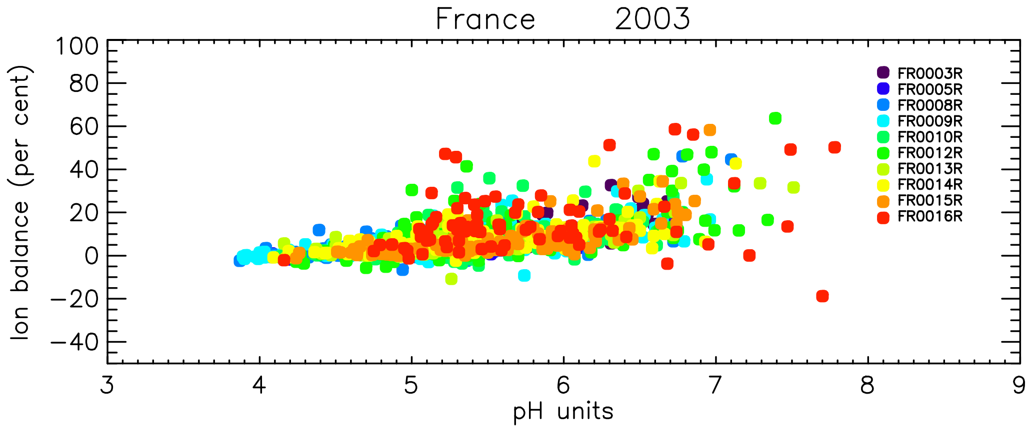

Germany 2003
Ion balance (per cent)
pH units
DE0001R
DE0002R
DE0002R
DE0003R
DE0004R
DE0004R
DE0005R
DE0007R
DE0008R
DE0009R

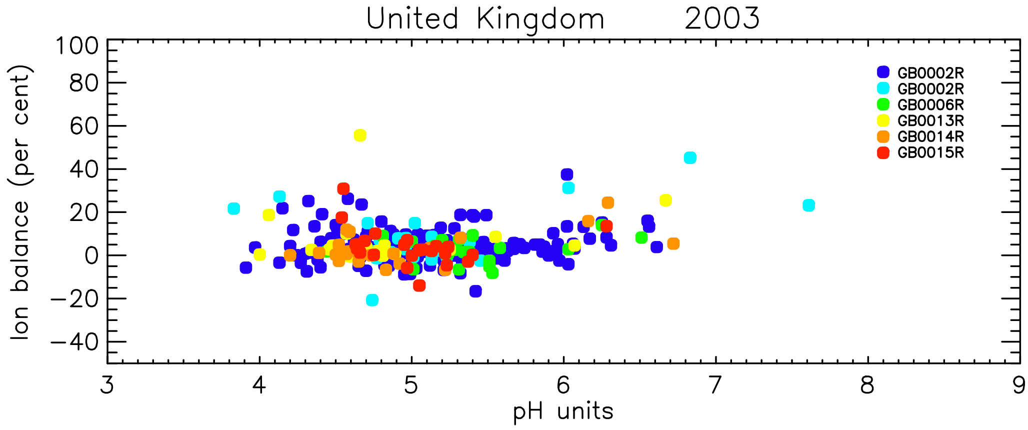

Denmark 2003
Ion balance (per cent)
pH units
DK0005R
DK0008R
DK0022R

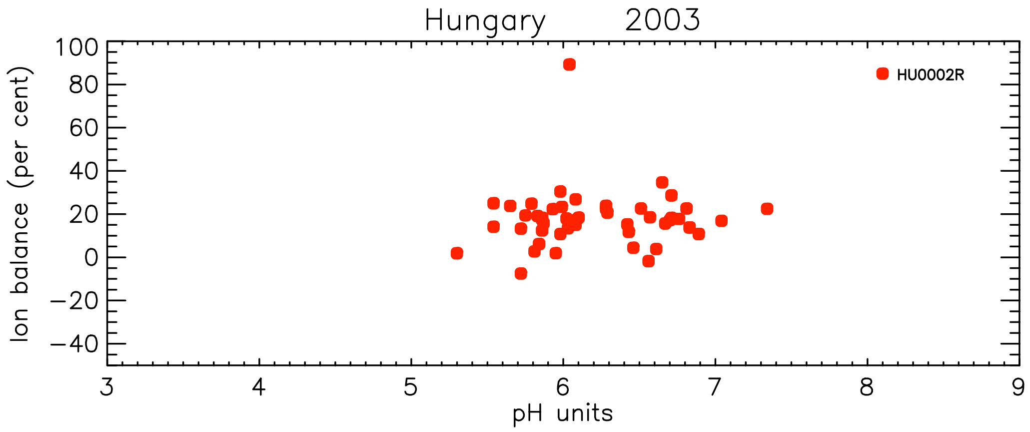

Estonia 2003
Ion balance (per cent)
pH units
EE0009R
EE0011R

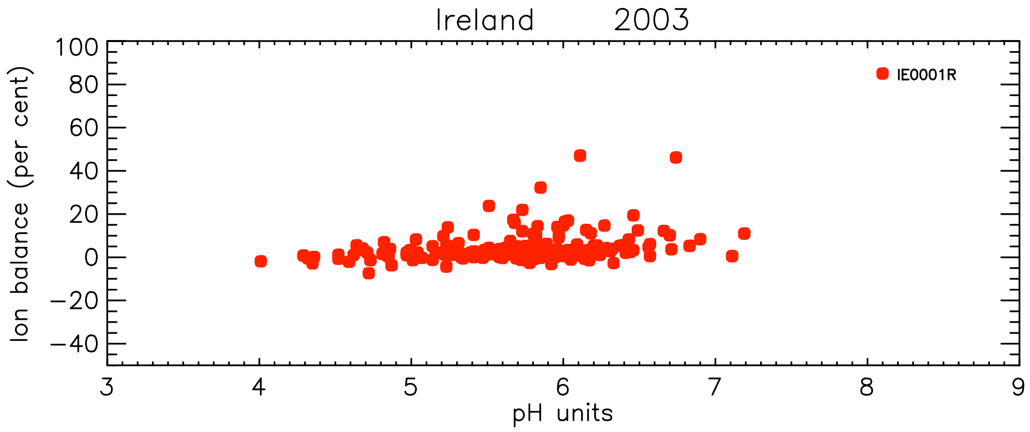

Spain 2003
Ion balance (per cent)
pH units
ES0007R
ES0008R
ES0009R
ES0011R
ES0012R
ES0013R
ES0014R
ES0015R
ES0016R

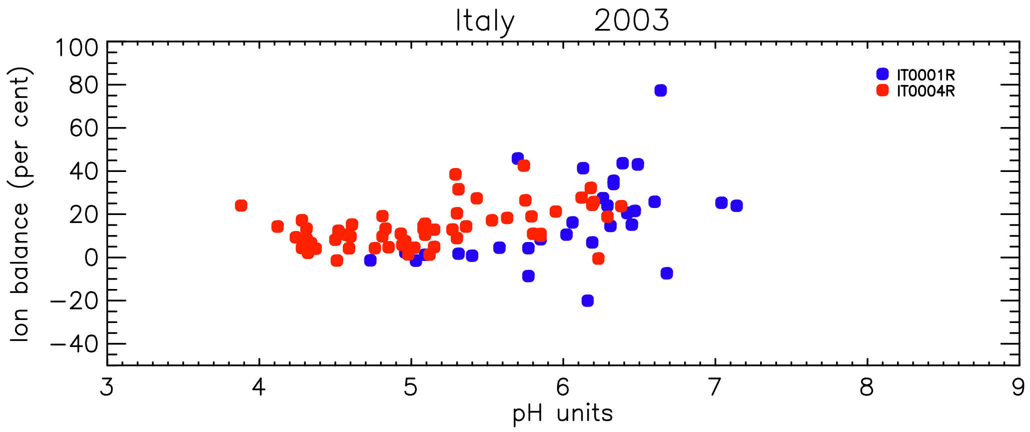

Finland 2003
Ion balance (per cent)
pH units
FI0004R
FI0009R
FI0017R
FI0022R

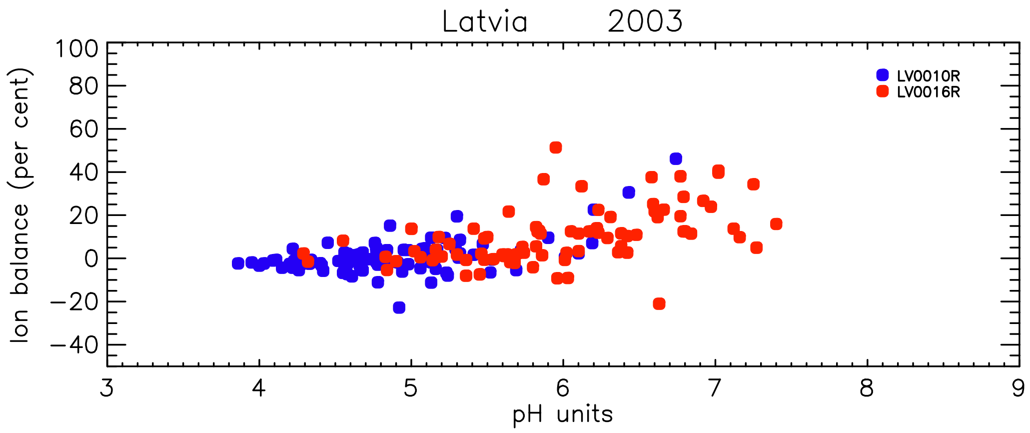

France 2003
Ion balance (per cent)
pH units
FR0003R
FR0005R
FR0008R
FR0009R
FR0010R
FR0012R
FR0013R
FR0014R
FR0015R
FR0016R

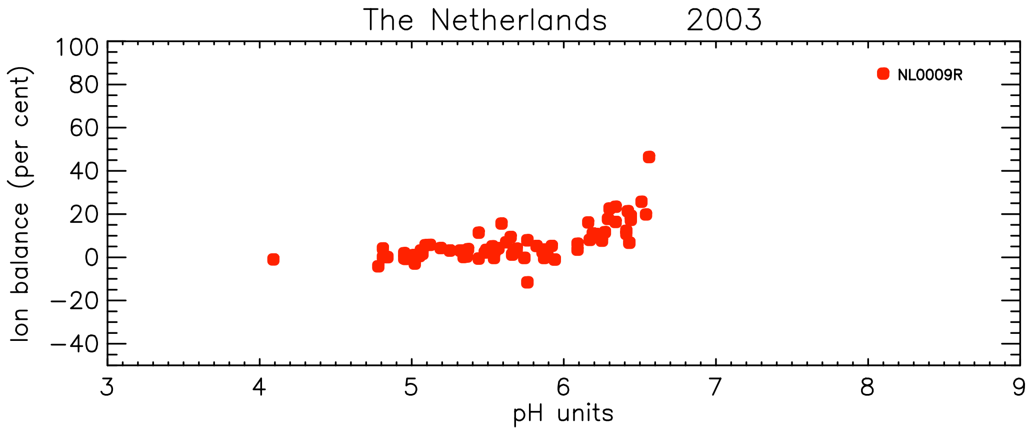

United Kingdom 2003
Ion balance (per cent)
pH units
GB0002R
GB0002R
GB0006R
GB0013R
GB0014R
GB0015R

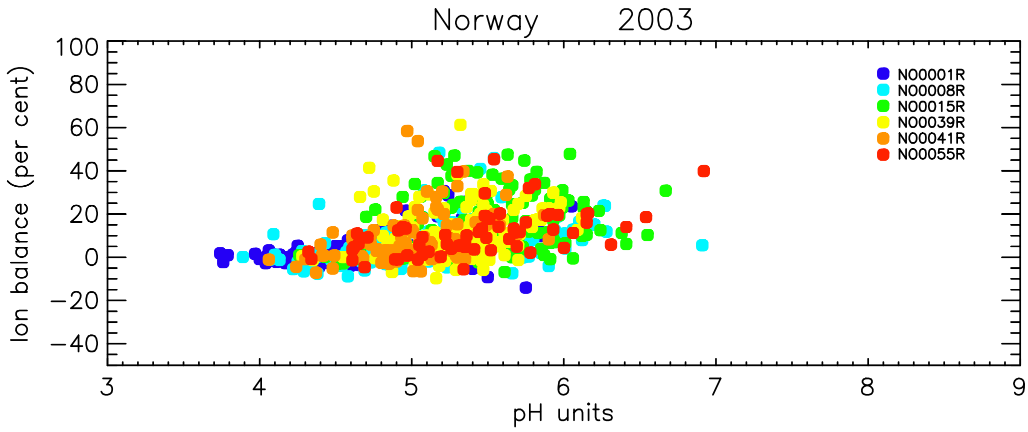

Hungary 2003
Ion balance (per cent)
pH units
HU0002R
100
80
60
40
20
0
−20
−40
3
4
5
6
7
8
9

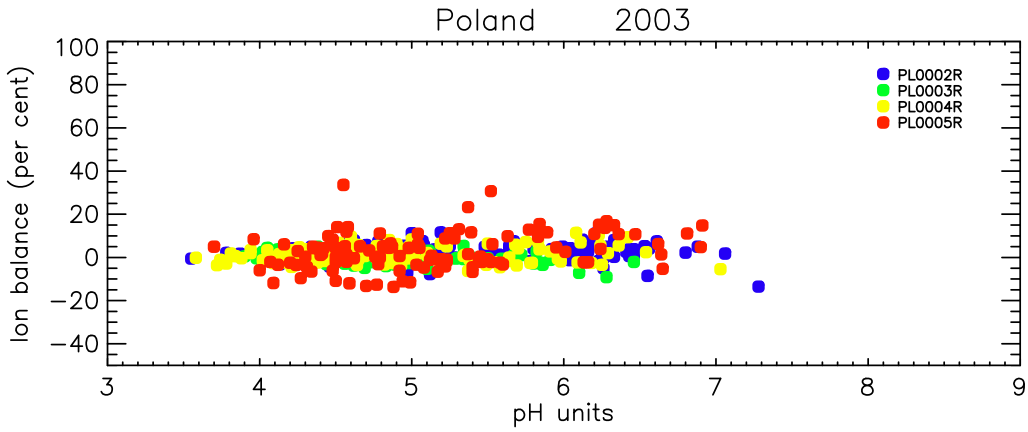

Ireland 2003
Ion balance (per cent)
pH units
IE0001R
100
80
60
40
20
0
−20
−40
3
4
5
6
7
8
9

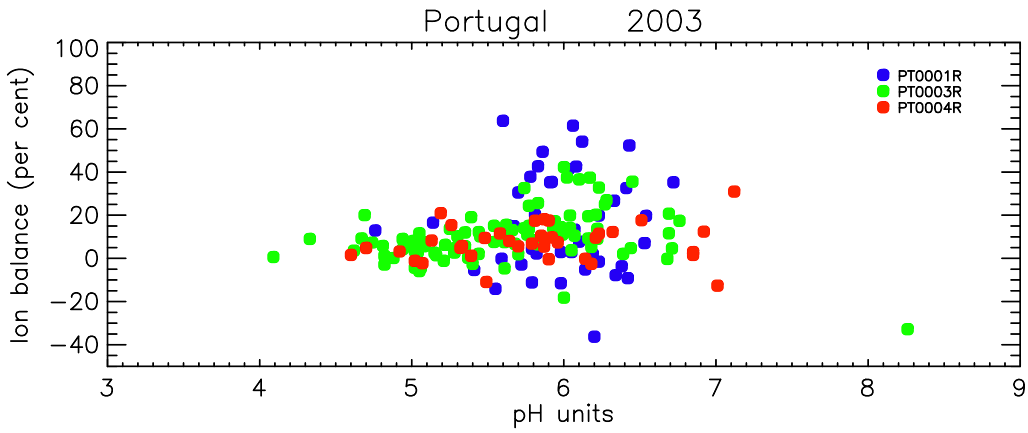

Italy 2003
Ion balance (per cent)
pH units
IT0001R
IT0004R
100
80
60
40
20
0
−20
−40
3
4
5
6
7
8
9

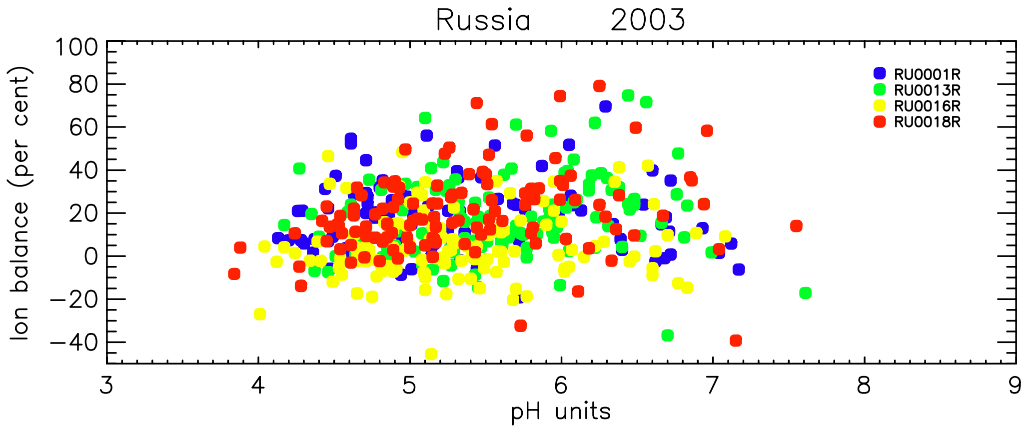

Latvia 2003
Ion balance (per cent)
pH units
LV0010R
LV0016R
100
80
60
40
20
0
−20
−40
3
4
5
6
7
8
9

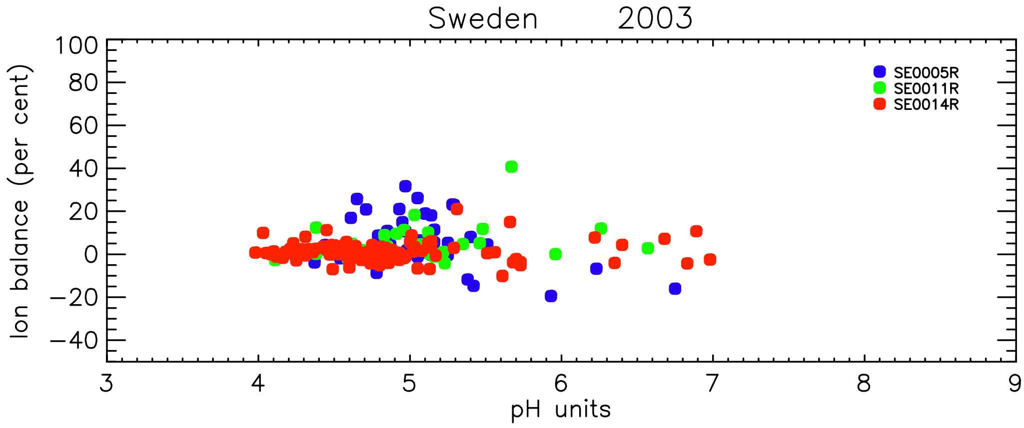

The Netherlands 2003
Ion balance (per cent)
pH units
NL0009R

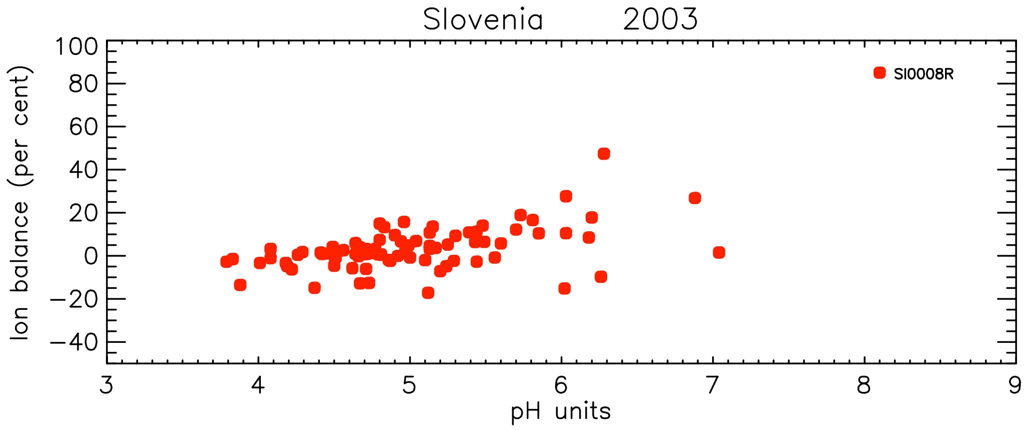

Norway 2003
Ion balance (per cent)
pH units
NO0001R
NO0008R
NO0015R
NO0039R
NO0041R
NO0055R

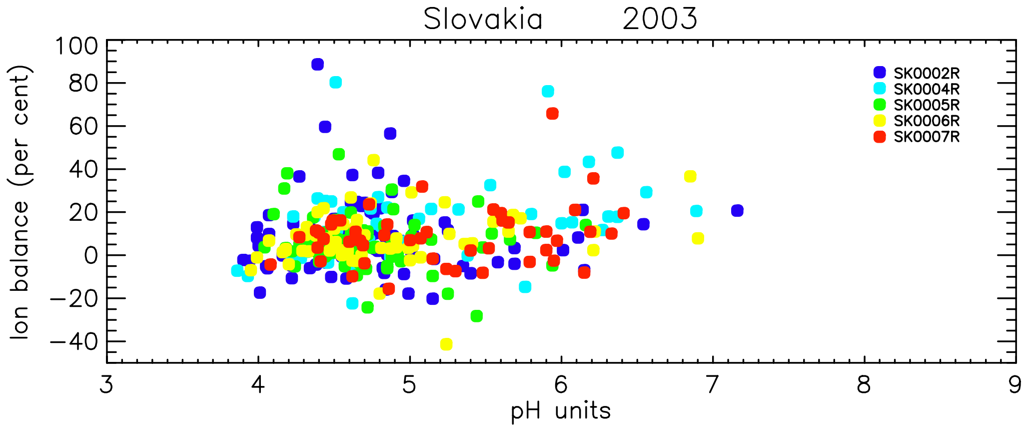

Poland 2003
Ion balance (per cent)
pH units
PL0002R
PL0003R
PL0004R
PL0005R

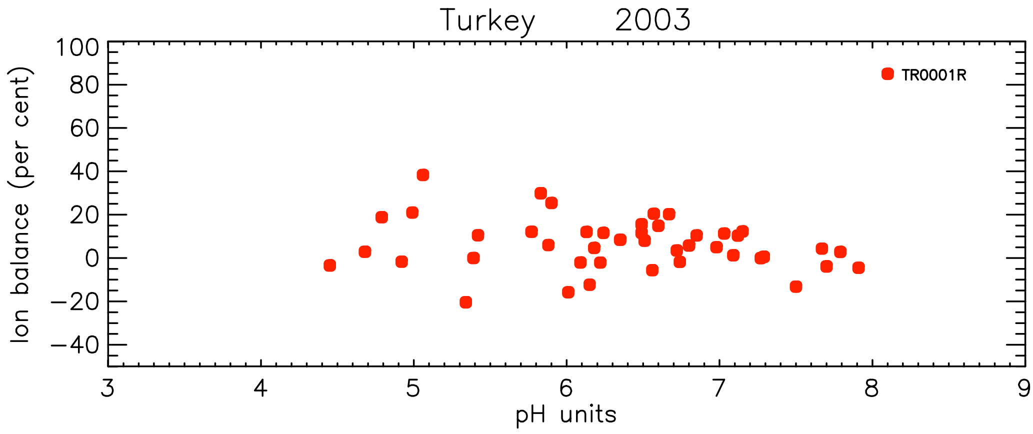

Portugal 2003
Ion balance (per cent)
pH units
PT0001R
PT0003R
PT0004R


Russia 2003
Ion balance (per cent)
pH units
RU0001R
RU0013R
RU0016R
RU0018R


Sweden 2003
Ion balance (per cent)
pH units
SE0005R
SE0011R
SE0014R


Slovenia 2003
Ion balance (per cent)
pH units
SI0008R


Slovakia 2003
Ion balance (per cent)
pH units
SK0002R
SK0004R
SK0005R
SK0006R
SK0007R


Turkey 2003
Ion balance (per cent)
100
80
60
40
20
0
−20
−40
3
4
5
6
7
8
9
pH units
TR0001R

Annex 5

Detection limits and precision

Table A5.1: Detection limits and precision of ozone.

Country	Precision	Detection limit	Instrument
Austria AT02,04 AT05	1 ppb	0.4 ppb 0.5 ppb	Horiba APOA 350E Horiba APOA 360
Belgium*	1 ppb	1 ppb 0.5 ppb	O341M Ozone Analyzer Monitor Labs, ML 9812
Czech Republic	RSD: 10%	2 µg/m^3	Thermo Electron Series 49
Denmark		1 ppb	API Model 400 and 400A
Estonia		2 µg/m^3	Thermo Environmental Instruments TEI 49 C
Finland FI04 FI09 FI17 FI22	2 µg/m^3	2 µg/m^3	TEI 49 C Dasibi 1008 PC, from 09.10.2003 Horiba APOA 360 TEI 49 C Dasibi 1008 PC
France FR08,09,10, 12,13,14,15,16	2 µg/m^3	2 µg/m^3	Environnement SA, O341M
Germany		2.0 µg/m^3	
Hungary			Thermo Environmental Instrument, Model 49
Ireland (IE01)			API Model400
Italy (IT01)	2 µg/m^3	1 µg/m^3	API Model400
Italy, EU (IT04)	2 ppb	2 ppb	Thermo Environmental Instrument, Model 49
Latvia	1%	1 ppb	O341M Ozone Analyzer
Netherlands	1%	4 µg/m^3	Thermo Environmental Instruments TEI 49 W
Norway	2 µg/m^3	2 µg/m^3	API Model 400
Poland PL05	2 µg or 1%, whichever is greater RSD 1.8%	2 µg/m^3 1 ppb	Monitor Labs Inc. ML-9810 Monitor Labs Inc. ML-9810
Portugal PT04	1 ppb	1 ppb	Dasibi Environmental corp. 1008 PC
Russia	2 µg/m^3	2 µg/m^3	Dasibi Environmental corp., DAS 1008 PC
Slovakia	2 µg/m^3	2 µg/m^3	TEI M49 (at SK02, 04, 06, 07)
Slovenia, SI08,32 SI31 SI33	1 ppb RSD: 0.5% 2 ppb	1 ppb 1 µg/m^3 2 ppb	Thermo Environmental Model 49 C API Model 400A Monitor Labs, ML 8810
Spain	2% 2 µg/m^3	1 ppb 2 µg/m^3	MCV, S.A. Model 48 AUV MCV, S.A. Model 0341 M
Sweden, SE11,12,14 SE32 SE13,35,39	1 ppb 1 ppb 1 ppb	1 ppb 1 ppb 1 ppb	Monitor Labs, ML 9810 (ML 9810 B at SE 12) Thermo Environmental Instrument, Model 49C Monitor Labs, ML 8810
Switzerland, CH02,03,04,05	uncertainty (95% conf. int.): 3%	2 µg/m^3	Thermo Environmental Instruments TEI 49C
UK, all sites except: GB32 GB43 GB44	2 ppb		Monitor Labs, ML 8810 TECO, TE49 Ambirack API Model 400

*Data from BE is taken from earlier years

Table A5.2: Detection limits and precision of sulphur dioxide.

Country	Measurements		Laboratory	
	Precision	Detection limit; µg S/m3	Precision	Detection limit
Austria[1]	0.7 ppb	0.1 ppb		
Czech Republic	CoV: 12.62% M.MAD : 0.194 µg SO_2/m^3	0.02	RSD : 3%	0.02 mg S/l
Denmark	M.MAD: 0.02; CoV: 5 %	DK03: 0.01 DK05: 0.02 DK08: 0.02	M.MAD: 0.01 µg S/m^3; CoV: 1.2%	0.01 µg S/m^3
Estonia		0.48		
Finland		0.04	M.MAD: 0.003 µg S/m^3 CoV: 1.0%	0.01 µg S/m^3
France			at 0.01<c<0.1 mg S/l: RSD = 8-12% at 0.1<c<0.5 mg S/l: RSD = 1-3%	0.1 mg S/L
Germany	M.MAD: < 0.02			0.01 µg/m^3
Hungary		0.24		2.49 µg S/m^3
Iceland		0.01	RSD: 4% at 1 mg S/l	0.05 mg S/l
Ireland				0.05 µgS/m^3
Italy (IT01)	RSD: 7.0% at 2.0 µg S/m^3	0.1		0.002 mg S/l
Italy, EU (IT04)[2]	0.5 ppb	1 ppb		
Latvia		0.05	RSD: 2.3%	0.12 mg S/l
Lithuania		0.021 µg S/m^3	at c<0.7 µg S/m^3: 2.4% RSD; at c>0.7 µgS/m3: 0.5-1.0 % RSD	0.017 mg S/l
Netherlands[4]	1%	1.5		
Norway	M.MAD 0.04; CoV: 12%	0.03		0.01 µg S/m3
Poland		0.2		0.04 mg S/l
PL05	M.MAD = 0.13; CoV= 11.2%	0.1	RSD: 0.73%	0.5 mg S/l
Russia	RU01: M.MAD 0.01; CoV= 3% RU18: M.MAD 0.01; CoV= 12%			
Serbia and Montenegro*				0.005 mg SO_2/m^3
Slovakia			4.49%	0.15 µg S/filter
Slovenia		0.053		0.135 mg S/l
Spain	1% or 0.2 ppb	0.08 ppb		
Sweden	uncertainty (95% conf. int): 13%	0.02	R: 2%	0.01 µg S/m^3
Switzerland CH01	RSD: 4%	0.02		
[3]CH02, CH04, CH05	uncertainty (95% conf. int.): 9%	0.3		
Turkey		0.14	M.MAD: 0.008; CoV: 1.8%	0.040 mg S/l
UK				0.01 mg S/l

[1] AT, Monitor, (TEI 43BS to 15th December, after that TEI 43 C trace level)
[2] IT04. Monitor Environment SA, AF 21M
[3] CH02, CH04: TEI 43C TL; CH05: TEI 43BS / from 21.08.02 TEI 43CTL
[4] NL: TEI 43W

*Data from CS is taken from earlier years

Table A5.3: Detection limits and precision of nitrogen dioxide.

Country	Measurements		Laboratory	
	Precision	Detection limit, µg N/m^3	Precision	Detection limit
Austria[1]	1 ppb	0.5 ppb		
Belgium* (BE01) (BE02)	0.6 µg N/m^3 1%	0.3 0.5 ppb		
Czech Republic	RSD: 12%	0.23	RSD: 3.4%	0.06 mg NO_2/l
Denmark		DK08: 0.07	M.MAD: 0.01 µg N/m^3; CoV: 3.45%	0.07 µg N/m^3
Estonia		0.07		
Finland**	0.3 µg N/m^3	0.3		
Hungary		0.12	M.MAD: 0.001; CoV: 6.846%	
Ireland				0.1 µg N/m^3
Italy (IT01)	0.6 µg N/m^3	0.3		
Italy, EU (IT04)[2]	0.5 ppb	0.5 ppb		
Latvia		0.13	RSD: 2.8%	0.007 mg N/l
Lithuania		0.08	at c<2.0 µg N/m^3: 3.75-6.9% RSD	0.03 mg N/l
Netherlands[4]	1%	0.3		
Norway	M.MAD: 0.13; CoV: 5%	0.03	RSD: 7.0% at c=0.03 mgN/l RSD: 4.6% at c=0.17 mgN/l RSD: 4.2% at c=0.08 mgN/l	0.0045 mg N/l
Poland		0.2	RSD: 1.0% at 0.304 mgN/l RSD: 5.9 % at 0.015 mgN/l	0.008 mg N/l
PL05	M.MAD: 0.37; CoV: 24.5%	0.02	RSD: 3.17%	0.02 mg N/l
Serbia and Montenegro*				0.003 mg NO_2/m^3
Slovakia			4.05%	0.003 mg N/l
Slovenia		0.08		0.02 mg N/l
Spain	0.05 ppb	0.03 ppb		
Sweden	uncertainty (95% conf.int.): 6%	0.3	R: 2%	0.02 mg N/l
Switzerland[3] CH04, CH05	uncertainty (95% conf. int.): 10%	0.06		
CH02, CH03	uncertainty (95% conf. int.): 7%	0.3		
CH01	uncertainty (95% conf. int.): 10%	0.02		
Turkey	M.MAD: 0.037; CoV: 10.2%	0.16	M.MAD: 0.022; CoV: 3.5%	0.02 mg N/l
UK	3.5 ppb			

[1]AT: Monitor, HORIBA APNA 360
[2]IT04: Monitor, Thermo Environment 42C
[3]CH04 and CH05: Monitor Labs 9841A; CH02 and CH03: APNA 360; CH01: Eco Physics CLD 770AL ppt + PLC 760
[4] NL: TEI 43W

* Data from BE and CS are taken from earlier years.
** FI: Monitor, Thermo Environment 42TCL

Table A5.4: Detection limits and precision of sulphate in air.

Country	Measurements		Laboratory	
	Precision	**Detection limit, µg S/m³**	**Precision**	**Detection limit**
Austria		0.05 µg/m³	RSD: 2.3%	0.0028 µg/m³
Czech Republic	M.MAD: 0.225 µg/m³, CoV: 8.6%	0.02	RSD: 3%	0.02 mg/l
Denmark	M.MAD: 0.05 µg S/m³ CoV: 6.5%	DK03: 0.01 DK05: 0.02 DK08: 0.01	M.MAD: 0.01 µg S/m³, CoV: 1.25%	0.02 µg S/m³
Estonia		0.53		
Finland		0.04	M.MAD: 0.002 µg S/m³; CoV: 0.5%	0.01 µg S/m³
France			at 0.01<c<0.1 mg S/l: RSD = 8-12% at 0.1<c<0.5 mg S/l: RSD = 1-3%	0.2 µg S/filter
Germany	M.MAD < 0.02 µg/m³			0.01 µg/m³
Hungary		0.10		<0.01 µg S/m³
Iceland		0.01	RSD: 4% at 1 mg S/l	0.05 mg S/l
Ireland				0.05 µg/m³
Italy (IT01)	RSD: 1.3% at 1 µg S/m³	0.01		0.002 mg S/l
Italy, EU (IT04)		0.009 ppm	CoV: 1.3%	0.004 mg S/l
Latvia		0.06	RSD: 2.3%	0.012 mg S/l
Lithuania		0.024	at c<1.0 µgS/m³: 7.2% RSD; at c>1.0 µgS/m³: 1.0% RSD	0.024 mg S/l
Netherlands			SD: 0.3 µg/m³	1.2 µg/m³
Norway	M.MAD 0.009 µg S/m³ at c<2.4 µg S/m³	0.01		
Poland		0.18		0.04 mg S/l
PL05	M.MAD: 0.08; CoV=10.4%	0.1	RSD: 4%	0.5 mg S/l
Russia	RU01: M.MAD 0.01; CoV=2.5% RU16: M.MAD 0.02; CoV=7.5% RU18: M.MAD 0.01; CoV=2.3%		CoV: 1.75 µg/m³	0.02 mg/l
Slovakia			3.99%	0.33 µg S/filter
Slovenia		0.028 mg S/l		0.028 ml S/l
Spain (in PM_{10})				0.02 µg S/m³
Sweden	uncertainty (95% conf. int.): 13%	0.005 µg SO_4-S/m³	R: 2%	0.005 mg S/l
Switzerland	RSD: 10%	0.04		
Turkey		0.025	M.MAD: 0.012; CoV: 1.7%	0.033 mg S/l
UK			RSD: 2%	0.01 mg S/l

Table A5.5: Detection limits and precision of nitrate and nitric acid in air.

Country	Measurements		Laboratory	
	Precision	Detection limit, µg N/m3	Precision	Detection limit
Austria		HNO_3: 0.020 µg/m^3 NO_3: 0.011 µg/m^3	HNO_3: RSD: 1.7%	HNO_3: 0.0006 µg/m^3 NO_3: 0.0009 µg/m^3
Czech Republic	aNO_3: M.MAD: 0.252 µg/m^3, CoV: 7.49%	0.02	RSD: 2%	0.02 mg N/l
Denmark	M.MAD: 0.04 µg N/m^3, CoV: 7,3%	DK03: 0.04 DK05: 0.06 DK08: 0.03	NO_3; M.MAD: 0,01 µg N/m^3, CoV: 1.0%	NO_3: 0.02 µg N/m^3
Finland		0.02	M.MAD: 0.001 µg N/m^3 CoV: HNO_3 = 5.0% and NO_3 = 0.9%	0.005 µg N/m^3
Germany	< 0.02 µg/m^3 M.MAD			0.01 µg/m^3
Hungary		HNO_3: 0.06; NO_3: 0.07		HNO_3: <0.01; NO_3: 0.09
Italy (IT01)	HNO_3: RSD: 6.2% at 0.25 µg N/m^3 NO_3: RSD: 1.5% at 1 µg N/m^3	HNO_3: 0.01 NO_3: 0.01		0.002 mg N/l
Italy, EU (IT04)		0.024	CoV: 1.2%	0.011 mg N/l
Latvia		HNO_3, NO_3: 0.01	RSD: 2.6%	0.011 mg N/l
Lithuania		0.014	c=0.3-1.0 µg N/m^3; 0.5-1.2% RSD	0.013 mg N/l
Norway	M.MAD 0.012 at <1.6 µg N/m^3	0.02		
Poland		0.02		0.01 mg N/l
PL05	M.MAD: 0.11; CoV: 16.9%	0.2	RSD: 2%	0.05 mg N/l
Russia	NO_3: RU18: M.MAD 0.01; CoV=4.9%			0.01 mg/l
Slovakia			HNO_3: 5.13%; NO_3: 4.17%	HNO_3: 0.1 µg N/filter; NO_3: 0.4 µg N/filter
Slovenia		NO_3-N: 0.013 µg N/m^3 HNO_3: 0.006 mg N/l		NO_3-N: 0.024 mg N/l HNO_3-N: 0.006 mg N/l
Spain				0.06 µg N/m^3
Sweden	uncertainty (95% conf. int.): 12%	NO_3-N: 0.005; HNO_3-N: 0.01	R: 2%	NO_3-N: 0.005; HNO_3-N: 0.01 mg N/l
Switzerland	RSD: 8%	0.04		
Turkey		NO_3: 0.03 HNO_3: 0.043	NO_3: M.MAD: 0.005; CoV: 4.3% HNO_3: M.MAD: 0.008; CoV: 26.21%	NO_3: 0.04 mg N/l HNO_3: 0.04 mg N/l

Table A5.6: Detection limits and precision of ammonia and ammonium in air.

Country	Measurements: Precision	Measurements: Detection limit, µg N/m^3	Laboratory: Precision	Laboratory: Detection limit
Austria		NH_3: 0.10 µg/m^3 NH_4: 0.013 µg/m^3	NH_3: RSD: 1.6%	NH_3: 0.006 µg/m^3 NH_4: 0.011 µg/m^3
Czech Republic	aNH_4: M.MAD: 0.315 µg/m^3 CoV: 12.10%	0.016	RSD: 2%	0.016 mg N/l
Denmark	M.MAD: 0.13 µg N/m^3 CoV: 6.6%	DK03: 0.05 DK05: 0.06 DK08: 0.03	NH_4: M.MAD: 0.01 µg N/m^3; CoV: 1.3% NH_3: M.MAD: 0.01 µg N/m^3; CoV: 1.0%	NH_4^+: 0.02 µg N/m^3 NH_3: 0.02 µg N/m^3
Finland		0.04	M.MAD: 0.004 µg N/m^3; CoV: 1.5%	0.01 µg/m^3
Germany	M.MAD < 0.02 µg/m^3			0.01 µg/m^3
Hungary		NH_3: 0.44; NH_4: 0.03		
Italy (IT01)	NH_3: RSD: 3.9% at 1 µg N/m^3 NH_4: RSD: 4.2% at 2 µg N/m^3	0.1		0.001 mg N/l
Italy, EU (IT04)		0.17	CoV: 2.4%	0.074 mg N/l
Latvia		0.09	RSD: NH_4: 4%; NH_3: 2%	NH_4; 0.03 mg N/l NH_3: 0.02 mg N/l
Lithuania		0.027	at c<1.0 µg N/m^3: 4.0% RSD at c>1.0 µg N/m^3: 0.6-1.8% RSD	0.04 mg N/l
Netherlands	NH_3: RSD: <2%	NH_3: 0.1	NH_4, SD: 0.05 µg/m^3	NH_4: 0.2 µg/m^3
Norway		0.05-0.1		
Poland		0.06		0.03 mg N/l
PL05	M.MAD: 0.24; CoV: 20.8%	0.03	RSD: 1.64%	0.01 mg N/l
Russia	NH_4: RU01: M.MAD 0.01; CoV=4.5% NH_4: RU16: M.MAD 0.01; CoV=3.5% NH_4: RU18: M.MAD 0.01; CoV=2.1%		NH_4: M.MAD: 0.01 µg/m^3 CoV: 3.39 µg/m^3	NH_4: 0.02 mg/l
Slovenia		NH_4-N: 0.020 NH_3-N: 0.040		NH_4-N: 0.048 mg N/l NH_3-N: 0.030 mg N/l
Spain		0.03	2.68 %	0.03 µg N/m^3
Sweden	uncertainty (95% conf. int.): 13%	NH_3-N: 0.03; NH_4-N: 0.02	R: 3%	NH_4: 0.017; NH_3: 0.03 (N mg/l)
Switzerland	RSD: 7%	0.1		
Turkey		NH_4: 0.62 µg N/m^3 NH_3: 0.12 µg N/m^3	NH_4: M.MAD: 0.041; CoV: 10.5% NH_3: M.MAD: 0.025; CoV: 33.7%	NH_4: 0.054 mg N/l NH_3: 0.041 mg N/l

Table A5.7: Detection limits and precision of sulphate in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, mg S/l	Precision	Detection limit, mg S/l
Austria		0.012	RSD: 0.92%	0.002
Belarus*				0.100
Czech Republic	CoV: 5.5% M.MAD: 0.153 mg/l	0.013	RSD: 1.4%	0.013
Denmark			M.MAD: 0.01 mg S/l; CoV: 1.6%	0.04
Estonia		0.347		0.221
Finland			M.MAD: 0.006 mg S/l; CoV: 2.0%	0.02
France			at c<0.2 mg S/l: RSD = 5-10% at 0.2<c<0.5 mg S/l: RSD = 3-5% at 0.5<c<5 mg S/l: RSD = 1-3%	0.02
Germany				0.01
Hungary	CoV: 2.03% M.MAD: 0.063 mg/l		M.MAD=0.019; CoV=1.25%	ca. 0.03*
Iceland		0.1	RSD: 4% at 1 mg S/l	0.05
Ireland				0.05
Italy (IT01)	RSD: 1.1% at 1 mg S/l	0.01	RSD: 0.8% at 0.5 mg S/l RSD: 1.6% at 0.05 mg S/l	0.002
Italy, EU (IT04)			CoV: 1.3%	0.004
Latvia		0.07	CoV: 3.3%	0.014
Lithuania			c<0.5 mgS/l: 3.4% RSD c>0.5 mgS/l: 1.0% RSD	0.02
Netherlands			SD: 0.2	0.07
Norway	M.MAD: 0.03, CoV: 7%		SD: 0.041 at c=2.23 mgS/l SD: 0.019 at c=0.85 mgS/l	0.01
Poland			RSD: 1% at 6.7 mg S/l RSD: 1.8% at 0.67 mg S/l RSD: 2% at 0.33 mgS/l	0.03
PL05	M.MAD: 0.04; CoV: 9.5%	0.1	M.MAD: 0.01; CoV: 3.6%	0.1
Portugal			0.75%	0.04
Russia			CoV: 0.78%	0.02
Serbia and Montenegro*				0.16
Slovakia			1.7%	0.017
Slovenia				0.015
Spain			CoV: 1.4 %	0.07
Sweden	uncertainty (95% conf. int.): 5% (0.004-1 mg/l) uncertainty (95% conf. int.): 1% (1-28 mg/l)	0.005	R: 2%	0.005
Switzerland	M.MAD: 0.01 mg S/l			0.01
Turkey			M.MAD: 0.017; CoV: 1.54%	0.036
UK			1%	0.01

* Data from BY and CS are taken from earlier years.

Table A5.8: Detection limits and precision of nitrate in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit mg N/l	Precision	Detection limit mg N/l
Austria		0.013	RSD: 0.7%	0.001
Belarus*				0.100
Czech Republic	CoV: 5.4% M.MAD: 0.155 mg/l	0.009	RSD: 0.9%	0.009
Denmark			M.MAD: 0.02 mg N/l; CoV: 2.6%	0.02
Estonia		0.302		0.167
Finland			M.MAD: 0.003 mg N/l; CoV: 1.5%	0.01
France			at c<0.2 mg N/l: RSD = 5-10% at 0.2<c<0.5 mg N/l: RSD = 3-5% at 0.5<c<5 mg N/l: RSD = 1-3%	0.02
Germany				0.01
Hungary	CoV: 5.81% M.MAD: 0.147 mg/l		M.MAD=0.003; CoV=0.25%	ca. 0.03*
Iceland		0.1	RSD: 7% at 1 mg N/l	0.01
Ireland				0.05
Italy (IT01)	RSD: 1.4% at 1 mg N/l	0.01	RSD: 0.7% at 0.5 mg N/l RSD: 1.5% at 0.05 mg N/l	0.002
Italy, EU (IT04)			CoV: 1.2%	0.011
Latvia		0.009	CoV: 0.2%	0.004
Lithuania			c<0.5 mg N/l: 5.1% RSD c>0.5 mg N/l: 1.8% RSD	0.013
Netherlands			SD: 0.01	0.06
Norway	M.MAD: 0.03, CoV: 8%		SD: 0.023 at c=0.86 mg N/ml SD: 0.016 at c=0.39 mg N/ml	0.01
Poland			RSD: 1.7% at 4.5 mg N/l RSD: 1.9% at 0.45 mg N/l RSD: 2.0% at 0.23 mg N/l	0.015
PL05	M.MAD: 0.02; CoV: 4.4%	0.1	M.MAD: 0.00; CoV: 0%	0.1
Portugal			0.25%	0.02
Russia				0.01
Serbia and Montenegro*				0.02
Slovakia			2.44%	0.01
Slovenia				0.009
Spain			CoV: 1.2%	0.08
Sweden	uncertainty (95% conf. int.): 5% (0.006-1 mg/l) uncertainty (95% conf. int.): 1% (1-6 mg/l)	0.006	R: 2%	0.006
Switzerland	M.MAD: 0.01 mg N/l			0.01
Turkey			M.MAD: 0.007; CoV: 1.53%	0.034
UK			1%	0.01

* Data from BY and CS are taken from earlier years.

Table A5.9: Detection limits and precision of ammonium in precipitation.

Country	Measurements		Laboratory	
	Precision	**Detection limit, mg N/l**	**Precision**	**Detection limit, mg N/l**
Austria		0.02	RSD 2.98%	0.007
Belarus*				0.050
Czech Republic	CoV: 11.4% M.MAD: 0.169 mg/l	0.016	RSD: 2%	0.016
Denmark			M.MAD: 0.01 mg N/l; CoV: 1.7%	0.01
Estonia		0.064		0.077
Finland			M.MAD: 0.001 mg N/l; CoV: 0.5%	0.002
France			at c<0.2 mg N/l: RSD = 5-10% at 0.2<c<0.5 mg N/l: RSD = 3-5% at 0.5<c<5 mg N/l: RSD = 1-3%	0.03
Germany				0.01
Hungary	CoV: 7.66% M.MAD: 0.062 mg/l		M.MAD=0.002; CoV=0.61%	ca. 0.04*
Ireland				0.05
Italy (IT01)	RSD: 0.8% at 0.5 mg N/l	0.005	RSD: 0.5% at 0.5 mg N/l RSD: 1.8% at 0.05 mg N/l	0.001
Italy, EU (IT04)			CoV: 2.4%	0.014
Latvia		0.06	CoV: 2.9%	0.015
Lithuania			c<1.0 mg N/l: 3.3% RSD c>1.0 mg N/l: 1.0% RSD	0.04
Netherlands			SD: 0.01	0.03
Norway	M.MAD: 0.06, CoV: 20%		SD: 0.016 at c=0.64 mg/l SD: 0.013 at c=0.32 mgN/l	0.01
Poland			RSD: 2.7% at 1 mg/l RSD: 4.6% at 0.1 mg/l	0.03
PL05	M.MAD: 0.04; CoV: 17.6%	0.01	M.MAD: 0.05; CoV: 14.9%	0.01
Portugal			0.79%	0.03
Russia			CoV: 2.24%; M.MAD: 0.02	0.02
Serbia and Montenegro*				0.03
Slovakia			3.39%	0.01
Slovenia				0.017
Spain			CoV: 2.7%	0.08
Sweden	uncertainty (95% conf. int.): 5% (0.01-1 mg/l) uncertainty (95% conf. int.): 2% (1-10 mg/l)	0.01	R: 3%	0.02
Switzerland	M.MAD: 0.02 mg N/l			0.02
Turkey			M.MAD: 0.017; CoV: 3.81%	0.034
UK			1%	0.01

* Data from BY and CS are taken from earlier years.

Table A5.10: Detection limits and precision of calcium in precipitation.

	Measurements		Laboratory	
Country	**Precision**	**Detection limit, mg/l**	**Precision**	**Detection limit, mg/l**
Austria		0.34	RSD: 2.02%	0.003
Belarus*				0.001
Czech Republic	CoV: 13.5% M.MAD: 0.107 mg/l	0.033	RSD:5.0%	0.033
Denmark			M.MAD: 0.01 mg/l; CoV: 3.9%	0.13
Estonia		0.407		0.382
Finland			M.MAD: 0.001 mg/l; CoV: 2.2%	0.005
France			at c<0.2 mg/l: RSD = 10-20% at 0.2<c<0.5 mg/l: RSD = 5-10% at 0.5<c<5 mg/l: RSD = 1-5%	0.02
Germany				0.01
Hungary	CoV: 6.62% M.MAD: 0.068 mg/l		M.MAD: 0.008; CoV: 3.83%	ca. 0.01*
Iceland		0.1	RSD: 1-3% at 1<c<6 mg Ca/l	0.02
Ireland				0.05
Italy (IT01)	RSD: 1.8% at 1 mg Ca/l	0.01	RSD: 1.2% at 0.5 mg Ca/l RSD: 3.6% at 0.05 mg Ca/l	0.002
Italy, EU (IT04)			CoV: 16%	0.014
Latvia		0.15	CoV: 4.5%	0.02
Lithuania			c<0.2mgCa/l: 5.5% RSD c>0.2 mgCa/l: 1.5% RSD	0.02
Netherlands			SD: 0.01	0.06
Norway	M.MAD: 0.03; CoV: 59%		SD: 0.010 at c=0.27 mg/l SD: 0.006 at c=0.15 mg/l	0.01
Poland			RSD: 0.9% at 2 mg/l RSD: 1.8% at 0.8 mg/l RSD: 2.1% at 0.4 mg/l	0.03
PL05	M.MAD: 0.03; CoV: 22.9%	0.02	M.MAD: 0.003; CoV: 1.4%	0.003
Portugal			1.31%	0.06
Russia			CoV: 5.88%; M.MAD: 0.03	0.05
Serbia and Montenegro*			81%	0.005
Slovakia			2.34%	0.03
Slovenia				0.014
Spain			CoV: 7.4%	0.04
Sweden	uncertainty (95% conf. int.): 10% (0.05-1 mg/l)	0.05	R: 5%	0.04
Switzerland	M.MAD: 0.02 mg/l			0.05
Turkey			M.MAD: 0.007; CoV: 0.60%	0.04
UK			1%	0.02

* Data from BY and CS are taken from earlier years.

Table A5.11: Detection limits and precision of potassium in precipitation.

Country	Measurements		Laboratory	
	Precision	**Detection limit, mg/l**	**Precision**	**Detection limit, mg/l**
Austria		0.014	RSD: 2.85%	0.005
Belarus*				0.050
Czech Republic	CoV: 10.4% M.MAD: 0.015 mg/l	0.007	RSD: 6%	0.007
Denmark			M.MAD: 0.01 mg/l; CoV: 3.6%	0.054
Estonia		0.095		0.1
Finland			M.MAD: 0.002 mg/l; CoV: 3.5%	0.006
France			at c<0.2 mg/l: RSD = 10-20% at 0.2<c<0.5 mg/l: RSD = 5-10% at 0.5<c<5 mg/l: RSD = 1-5%	0.02
Germany				0.01
Hungary	CoV: 5.24% M.MAD: 0.010 mg/l		M.MAD: 0.002; CoV: 2.22%	ca. 0.01*
Iceland		0.1	RSD: 5-10% at 1<c<6 mg K/l	0.4
Ireland				0.05
Italy (IT01)	RSD: 1.4% at 1 mg K/l	0.01	RSD: 1.5% at 0.5 mg K/l RSD: 3.0% at 0.05 mg K/l	0.03
Italy, EU (IT04)			CoV: 3.7%	0.005
Latvia		0.1	CoV: 2.3%	0.03
Lithuania			RSD: 8.1% at c<0.5 mg K/l	0.02
Netherlands			SD: 0.01	0.04
Norway	M.MAD: 0.03; CoV: 59%		SD: 0.027; c=0.61 mg/l SD: 0.015; c=0.20 mg/l	0.01
Poland			RSD: 1.0% at 0.5 mg/l RSD: 2.9% at 0.1 mg/l RSD: 2.4% at 0.05 mg/l	0.02
PL05	M.MAD: 0.016; CoV: 24.4%	0.04	M.MAD: 0.003; CoV: 5.1%	0.002
Portugal			1.69%	0.077
Russia			CoV: 5.20%; M.MAD: 0.02	0.03
Serbia and Montenegro*			98%	0.015
Slovakia			2.34%	0.03
Slovenia				0.027
Spain			CoV: 18%	0.05
Sweden	uncertainty (95% conf. int.): 10% (0.08-1 mg/l) 6% (1-15 mg/l)	0.08	R: 8%	0.05
Switzerland	M.MAD: 0.01 mg/l			0.01
Turkey			M.MAD: 0.006; CoV: 2.4%	0.015
UK			1%	0.02

* Data from BY and CS are taken from earlier years.

Table A5.12: Detection limits and precision of chloride in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, mg/l	Precision	Detection limit, mg/l
Austria		0.034	RSD: 2.65%	0.009
Belarus*				0.050
Czech Republic	CoV: 14.5% M.MAD: 0.072 mg/l	0.018	RSD: 1.4%	0.018
Denmark			M.MAD: 0.08 mg/l; CoV: 3.7%	0.08
Estonia		0.463		0.155
Finland			M.MAD: 0.003 mg/l; CoV: 1.4%	0.01
France			at c<0.2 mg/l: RSD = 10-20% at 0.2<c<0.5 mg/l: RSD = 5-10% at 0.5<c<5 mg/l: RSD = 1-5%	0.05
Germany				0.01
Hungary	CoV: 11.51% M.MAD: 0.052 mg/l		M.MAD: 0.032; CoV: 13.17%	ca. 0.1*
Iceland		0.1	RSD: 4% at 1 mg Cl/l	0.1
Ireland				0.05
Italy (IT01)	RSD: 0.7% at 0.5 mg Cl/l	0.005	RSD: 0.6% at 0.5 mg Cl/l RSD: 1.1% at 0.05 mg Cl/l	0.001
Italy, EU (IT04)			CoV: 2.1%	0.009
Latvia		0.36	CoV: 3.7%	0.05
Lithuania			c<0.5 mg Cl/l: 4.7% RSD c>0.5 mg Cl/l: 2.3% RSD	0.01
Netherlands			SD: 0.04	0.18
Norway	M.MAD: 0.16, CoV: 22%		SD: 0.028 at c=1.16 mg/l SD: 0.02 at c=0.46 mg/l	0.01
Poland			RSD: 1.9% at 10 mg/l RSD: 2% at 1 mg/l RSD: 2.6% at 0.5 mg/l	0.02
PL05	M.MAD: 0.02; CoV: 11.3%	0.1	M.MAD: 0.04; CoV: 4%	0.1
Portugal			0.53%	0.03
Russia				0.03
Serbia and Montenegro*				0.05
Slovakia			2.86%	0.04
Slovenia				0.014
Spain			CoV: 4.9%	0.31
Sweden	uncertainty (95% conf. int.): 8% (0.05-1 mg/l) uncertainty (95% conf. int.): 3% (1-32 mg/l)	0.05	R: 2%	0.05
Switzerland	M.MAD: 0.02 mg/l			0.02
Turkey			M.MAD: 0.069; CoV: 7.9%	0.043
UK			1%	0.02

* Data from BY and CS are taken from earlier years.

Table A5.13: Detection limits and precision of magnesium in precipitation.

Country	Measurements		Laboratory	
	Precision	**Detection limit, mg/l**	**Precision**	**Detection limit, mg/l**
Austria		0.023	RSD: 1.34%	0.002
Belarus*				0.001
Czech Republic	CoV: 10.6% M.MAD: 0.015 mg/l	0.001	RSD: 3%	0.001
Denmark			M.MAD: 0.02 mg/l; CoV: 7.0%	0.02
Estonia		0.077		0.089
Finland			M.MAD: 0.001 mg/l; CoV: 2.1%	0.003
France			at c<0.2 mg/l: RSD = 10-20% at 0.2<c<0.5 mg/l: RSD = 5-10% at 0.5<c<5 mg/l: RSD = 1-5%	0.02
Germany				0.01
Hungary	CoV: 3.47% M.MAD: 0.010 mg/l		M.MAD: 0.004; CoV: 6.85%	ca. 0.01*
Iceland		0.1	RSD: 1-3% at 1<c<6 mg Mg/l	0.005
Ireland				0.05
Italy (IT01)	RSD: 1.1% at 0.5 mg Mg/l	0.005	RSD: 0.8% at 0.5 mg Mg/l RSD: 3.2% at 0.05 mg Mg/l	0.001
Italy, EU (IT04)			CoV: 2.2%	0.002
Latvia		0.04	CoV: 4.1%	0.020
Netherlands			SD: 0.01	0.02
Norway	M.MAD: 0.01, CoV: 30%		SD: 0.012 at c=0.31 mg/l SD: 0.007; c=0.19 mg/l	0.01
Poland			RSD: 1.0% at 0.25mg/l RSD: 1.0% at 0.1 mg/l RSD: 2.4% at 0.025 mg/l	0.007
PL05	M.MAD: 0.004; CoV: 13.4%	0.01	M.MAD: 0.001; CoV: 2.2%	0.001
Portugal			0.60%	0.03
Russia			CoV: 8.17%; M.MAD: 0.09	0.001
Serbia and Montenegro*			99.5%	0.002
Slovakia			2.16%	0.01
Slovenia				0.01
Spain			CoV: 7.2%	0.02
Sweden	uncertainty (95% conf. int.): 20% (0.02-1 mg/l) uncertainty (95% conf. int.): 5% (1-15 mg/l)	0.02	R: 5%	0.01
Switzerland	M.MAD: 0.01 mg/l			0.001
Turkey			M.MAD: 0.002; CoV: 1.03%	0.005
UK			1%	0.01

* Data from BY and CS are taken from earlier years.

Table A5.14: Detection limits and precision of sodium in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, mg/l	Precision	Detection limit, mg/l
Austria		0.030	RSD: 1.8%	0.003
Belarus*				0.050
Czech Republic	CoV: 15.5% M.MAD: 0.019 mg/l	0.004	RSD: 3%	0.004
Denmark		DK03: 0.09 μg/m³ DK05: 0.14 μg/m³ DK08: 0.09 μg/m³	M.MAD: 0.10 mg/l; CoV: 2.5%	0.04 μg/m³
Estonia		0.095		0.1
Finland			M.MAD: 0.001 mg/l; CoV: 0.9%	0.002
France			at c<0.2 mg/l: RSD = 10-20% at 0.2<c<0.5 mg/l: RSD = 5-10% at 0.5<c<5 mg/l: RSD = 1-5%	0.02
Germany				0.01
Hungary	CoV: 10.65% M.MAD: 0.073 mg/l		M.MAD: 0.010 mg/l; CoV: 4.71%	ca. 0.01*
Iceland		0.1	RSD: 1-3% at 1<c<6 mg Na/l	0.01
Ireland				0.05
Italy (IT01)	RSD: 0.9% at 0.5 mg Na/l	0.005	RSD: 1.3% at 0.5 mg Na/l RSD: 2.0% at 0.05 mg Na/l	0.001
Italy, EU (IT04)			CoV: 2.1%	0.011
Latvia		0.06	CoV: 3.6%	0.03
Lithuania			RSD: 2.4-5.7%	0.02
Netherlands			SD: 0.01	0.05
Norway	M.MAD: 0.09, CoV: 22%		SD: 0.025 at c=0.75 mg/l SD: 0.011 at c=0.30 mg/l	0.01
Poland			RSD: 0.8% at 1 mg/l RSD: 1.4% at 0.4 mg/l RSD: 2.3% at 0.2 mg/l	0.02
PL05	M.MAD: 0.006; CoV: 11%	0.02	M.MAD: 0.004; CoV: 5.7%	0.003
Portugal			0.54%	0.025
Russia			CoV: 0.45%	0.01
Serbia and Montenegro*			98.25%	0.001
Slovakia			2.09%	0.04
Slovenia				0.012
Spain			CoV: 14%	0.1
Sweden	uncertainty (95% conf. int.): 6% (0.12-1 mg/l) uncertainty (95% conf. int.): 2% (1-15 mg/l)	0.12	R: 4%	0.05
Switzerland	M.MAD: 0.02 mg/l			0.02
Turkey			M.MAD: 0.013; CoV: 1.79%	0.064
UK			1%	0.01

* Data from BY and CS are taken from earlier years.

Table A5.15: Detection limits and precision of arsenic in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, µg/l	Precision	Detection limit, µg/l
Estonia		0.2		
Finland			M.MAD: 0.008 µg/l; CoV: 10.5%	0.006
Germany				0.004
Iceland				0.1
Latvia			CoV: 6.5%	0.7
Netherlands			SD: 0.02	0.06
Norway				0.1
Poland PL05				0.05
Slovakia			3.5%	0.04
UK				0.04 mg/l

Table A5.16: Detection limits and precision of cadmium in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, µg/l	Precision	Detection limit, µg/l
Czech Republic	CoV: 2.32% M.MAD: 0.021 µg/l	0.01	RSD: 7%	0.01
Estonia		0.01		
Finland			M.MAD: 0.002 µg/l CoV: 3.0%	0.002
Germany				0.003
Iceland				0.005
Latvia			CoV: 8.1%	0.03
Netherlands			SD: 0.002	0.01
Norway				0.005
Poland PL05				0.003
Slovakia			1.09%	0.03
UK				0.04 mg/l

Table A5.17: Detection limits and precision of chromium in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, µg/l	Precision	Detection limit, µg/l
Finland			M.MAD: 0.04 µg/l; CoV: 21.8%	0.02
Germany				0.01
Iceland				0.2
Netherlands			SD: 0.08	0.3
Norway				0.2
Poland PL05				0.02
Slovakia			3.0%	0.04
UK				0.008 mg/l

Table A5.18: Detection limits and precision of copper in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, µg/l	Precision	Detection limit, µg/l
Estonia		26		
Finland			M.MAD: 0.057 µg/l; CoV: 4.7%	0.05
Germany				0.01
Iceland				0.1
Latvia			CoV: 5.4%	0.4
Netherlands			SD: 0.05	0.2
Norway				0.1
Poland PL05				0.01
Slovakia			3.15%	0.2
UK				0.003 mg/l

Table A5.19: Detection limits and precision of iron in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, µg/l	Precision	Detection limit, µg/l
Czech Republic	CoV: 1.02%, M.MAD : 0.012mg/l	6	RSD: 7%	6
Finland			M.MAD: 3.21 µg/l CoV: 9.6%	1.5
Germany				0.5
Netherlands			SD: 3	13

Table A5.20: Detection limits and precision of manganese in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, µg/l	Precision	Detection limit, µg/l
Czech Republic	CoV: 10.75% M.MAD: 0.839 µg/l	0.4	RSD: 6%	0.4
Finland			M.MAD: 0.073 µg/l CoV: 3.4%	0.005
Latvia			CoV: 2.8%	10
Slovakia			3.5%	0.05

Table A5.21: Detection limits and precision of nickel in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, µg/l	Precision	Detection limit, µg/l
Czech Republic	CoV: 9.12% M.MAD: 0.210 µg/l	0.6	RSD: 8%	0.6
Finland			M.MAD: 0.04 µg/l CoV: 15.5%	0.02
Germany				0.2
Iceland				0.2
Latvia			CoV: 7.3%	0.9
Netherlands			SD: 0.05	0.06
Norway				0.2
Poland PL05				0.02
Slovakia			1.57%	0.1
UK				0.009 mg/l

Table A5.22: Detection limits and precision of lead in precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, μg/l	Precision	Detection limit, μg/l
Czech Republic	CoV: 10.73% M.MAD: 0.325 μg/l	0.5	RSD: 8%	0.5
Estonia		0.6		
Finland			M.MAD: 0.049 μg/l CoV: 3.7%	0.03
Germany				0.002
Iceland				0.01
Latvia			CoV: 4.7%	0.4
Netherlands			SD: 0.02	0.06
Norway				0.01
Poland PL05				0.01
Slovakia			1.21%	0.2
UK				0.002 mg/l

Table A5.23: Detection limits and precision of zinc precipitation.

Country	Measurements		Laboratory	
	Precision	Detection limit, μg/l	Precision	Detection limit, μg/l
Czech Republic	CoV: 8.92% M.MAD: 0.002 mg/l	3	RSD: 6%	3
Finland			M.MAD: 0.183 μg/l CoV: 3.1%	0.03
Germany				0.2
Iceland				0.1
Latvia			CoV: 2.3%	20
Netherlands			SD: 0.5	1.9
Norway				0.1
Poland PL05	M.MAD: 2.0 μg Zn/l; CoV: 24%	0.2	M.MAD: 0.2; CoV 2%	0.4
Slovakia			5.91%	1.7
UK				0.1 mg/l

Table A5.24: Detection limits and precision of arsenic in air.

Country	Measurements		Laboratory	
	Precision	Detection limit, ng/m^3	Precision	Detection limit
Czech Republic	CoV: 8.56% M.MAD: 0.052 ng/m^3	0.02	RSD: 10%	0.107 μg/l
Germany				0.004 μg/l
Iceland		0.0004		
Latvia		0.06	CoV: 4.8%	2.0 μg/l
Netherlands			0.04	0.2 ng/m^3
Norway, NO42 NO99				0.005 ng/m^3 fine: 0.9 ng/m^3; coarse: 0.24 ng/m^3
Slovakia			5.5%	4.7 ng/filter
Slovenia				0.162 ng/m^3

Table A5.25: Detection limits and precision of cadmium in air.

Country	Measurements		Laboratory	
	Precision	Detection limit, ng/m^3	Precision	Detection limit
Czech Republic	CoV: 15.1% M.MAD: 0.021 ng/m^3	0.005	RSD: 5%	0.025 µg/l
Germany				0.003 µg/l
Iceland		0.0002		
Lativia		0.01	CoV: 3.5%	0.24 µg/l
Netherlands			0.01	0.04 ng/m^3
Norway, NO42				0.002 ng/m^3
NO99				fine: 0.002 ng/m^3; coarse: 0.001 ng/m^3
Slovakia			3.11%	1.0 ng/filter
Slovenia				0.081 ng/m^3
Spain				0.01 ng/m^3

Table A5.26: Detection limits and precision of chromium in air.

Country	Measurements		Laboratory	
	Precision	Detection limit, ng/m^3	Precision	Detection limit
Iceland		0.02		
Norway, NO42				0.02 ng/m^3
NO99				fine: 0.3 ng/m^3; coarse: 0.6 ng/m^3
Slovakia			3.84%	8 ng/filter
Slovenia				0.3 ng/m^3

Table A5.27: Detection limits and precision of copper in air.

Country	Measurements		Laboratory	
	Precision	Detection limit, ng/m^3	Precision	Detection limit
Germany				0.01 µg/l
Iceland		0.0004		
Latvia		0.13	CoV: 1.6%	2.6 µg/l
Norway, NO42				0.01 ng/m^3
NO99				fine: 0.04 ng/m^3; coarse: 0.02 ng/m^3
Slovakia			1.46%	4 ng/filter
Slovenia				0.3 ng/m^3
Spain				0.18 ng/m^3

Table A5.28: Detection limits and precision of manganese in air.

Country	Measurements		Laboratory	
	Precision	Detection limit, ng/m^3	Precision	Detection limit
Germany				0.002 µg/l
Iceland		0.0008		
Latvia		0.20	CoV: 1.7%	6.0 µg/l
Norway, NO42				0.07 ng/m^3
Slovakia			3.26%	1.3 ng/filter

Table A5.29: Detection limits and precision of nickel in air.

Country	Measurements		Laboratory	
	Precision	Detection limit, ng/m³	Precision	Detection limit
Germany				0.01 μg/l
Iceland		0.0001		
Latvia		0.20	CoV: 3.2%	5.4 μg/l
Norway, NO42				0.02 ng/m³
NO99				fine: 0.008 ng/m³; coarse: 0.02 ng/m³
Slovakia			4.08%	10 ng/filter
Slovenia				0.3 ng/m³

Table A5.30: Detection limits and precision of lead in air.

Country	Measurements		Laboratory	
	Precision	Detection limit, ng/m³	Precision	Detection limit
Czech Republic	CoV: 9.01% M.MAD: 0.734 ng/m³	0.01	RSD: 3%	0.05 μg/l
Germany				0.002 μg/l
Iceland		0.00004		
Latvia		0.09	CoV: 1.0%	1.8 μg/l
Netherlands			0.06	0.2 ng/m³
Norway, NO42				0.007 ng/m³
NO99				fine: 0.008 ng/m³; coarse: 0.004 ng/m³
Slovakia			2.5%	3 ng/filter
Slovenia				3.2 ng/m³
Spain				0.4 ng/m³

Table A5.31: Detection limits and precision of zinc in air.

Country	Measurements		Laboratory	
	Precision	Detection limit, ng/m³	Precision	Detection limit
Iceland		0.0004		
Latvia		0.43	CoV: 2.2%	20 μg/l
Netherlands			3.6	15 ng/m³
Norway, NO42				0.01 ng/m³
NO99				fine: 0.05 ng/m³; coarse: 0.02 ng/m³
Slovakia			5.5%	70 ng/filter

Table A5.32: Detection limits and precision of measurements of particulate matter.

Country	Precision	Detection limit
Germany (PM_{10})		1 $\mu g/m^3$
Italy IT01 (PM_{10})	2.00%	2 $\mu g/m^3$
Netherlands		10 $\mu g/m^3$
Norway (PM_{10})	RSD: 5%	0.2 $\mu g/^{m3}$
Slovakia (TSP)	5.0%	0.06 mg/filter
Slovenia		1 $\mu g/m^3$
Spain (PM_{10} and $PM_{2.5}$)	2.00%	1 $\mu g/m^3$
Sweden (PM_{10}, hr mean)	2.2 $\mu g/m^3$	3 $\mu g/m^3$
Switzerland ($PM_{10}/PM_{2.5}$)	uncertainty (95% conf. int.): 10%	1 $\mu g/m^3$
UK	4 $\mu g\ m^{-3}$	

Table A5.33: Detection limits and precision of volatile organic carbons, VOC.

	Laboratory detection limit. [ppb]					
Compound	**Czech Republic**	**France**	**Germany**	**Finland**	**Spain**	**UK**
VOC (general)		0.01	0.01		0.01	0.01
Ethane	0.055			0.006		
Ethene	0.020			0.008		
Ethyne	0.041			0.020		
Propane	0.008			0.007		
Propene	0.011			0.010		
Propyne	0.003			0.013		
N-butane	0.003			0.007		
2-methyl propane (i-butane)	0.005			0.008		
2-methyl propene (i-butene)	0.006			0.008		
1-butene	0.009			0.008		
Trans-2-butene	0.004			0.009		
Cis-2-butene	0.008			0.007		
1,3-butadiene	0.009			0.009		
N-pentane	0.003			0.007		
2-methyl butane (i-pentane)	0.008			0.007		
1-pentene						
Trans-2-pentene	0.012			0.011		
Cis-2-pentene	0.009			0.010		
2-methyl pentane	0.003			0.008		
3-methyl pentane	0.012			0.006		
Isoprene	0.006			0.010		
N-hexane	0.011			0.006		
Hexene						
Cyclohexane	0.003			0.006		
N-heptane	0.023			0.005		
Benzene	0.012			0.004		
Methyl benzene (toluene)	0.021			0.004		
Ethyl benzene	0.019					
1,3-dimethyl benzene (m-xylene)	0.058					
1,2-dimethyl benzene (o-xylene)	0.013					
1,3,5-trimethyl benzene	0.013					
1,2,4-trimethyl benzene	0.007					
2 and 3-methyl pentane (combined areas)	5.8					
		in ug/m^3				
methanal		0.03				
ethanal		0.025				
propanone		0.03				
propenal		0.03				
propanal		0.03				
MVK		0.025				
butanal+isobutanal		0.04				
benzaldéhyde		0.03				
pentanal+tolualdehyde		0.04				
hexanal		0.03				
glyoxal		0.025				
methylglyoxal		0.03				
methylpropenal		0.025				
ethylmethylketone		0.03				

Table A5.34: Detection limits and precision of persistent organic pollutants (POP).

Compound	Laboratory detection limit, pg/m^3		
	Czech Republic	Norway	UK
PCB 28	0.5	0.05	
PCB 31	0.5	0.05	
PCB 52	0.5	0.05	
PCB 101	0.5	0.05	
PCB 105	0.5	0.05	
PCB 118	0.5	0.05	
PCB 138	0.5	0.05	
PCB 153	0.5	0.05	
PCB 153	0.5	0.05	
PCB 180	0.5	0.05	
alfa-HCH	0.5	0.05	
beta-HCH	0.5		
gamma-HCH	0.5	0.05	
delta-HCH	0.5		
HCB	0.5	0.05	
p,p'-DDE	0.5	0.05	
p,p'-DDD	0.5	0.05	
p,p'-DDT	0.5	0.05	
Hexachlorbenzene	0.5	0.05	
Pentachlorbenzene	0.5		
tr-chlordane		0.05	
cis-chlordane		0.05	
tr-nonachlor		0.05	
cis-nonachlor		0.05	
PAH (general)		1	
Naphtalene	2.5		
Acenaphthylene	2.5		
Acenaphthene	2.5		
Fluorene	2.5		
Phenanthrene	2.5		
Anthracene	2.5		
Fluoranthene	2.5		
Pyrene	2.5		
Benz[a]antracene	2.5		
Chrysene	2.5		
Benzo[b]fluorantene	2.5		
Benzo[k]fluorantene	2.5		
Benzo[a]pyrene	2.5		< 10
Indeno[123cd]pyrene	2.5		
Dibenz[ah]anthracene	2.5		
Benzo[ghi]perylene	2.5		

Annex 6

Classification of the QA flags

Table A6.1: Criteria used for classification of data quality based on field comparison results.

Regression slope (a) Ref = a*Lab	M.MAD / CoV	≤ 0.25 µg S/m^3	[0, 25 %]	≤ 0.50 µg S or N/m^3	< 25%, 50 %]	> 0.50 µg S or N/m^3 and < 50%, → >
	[1.50, → >	80	81	82	83	84
	[1.30, 1.50]	60	61	62	63	64
	[1.20, 1.30]	40	41	42	43	44
	[1.10, 1.20]	20	21	22	23	24
	[0.90, 1.10]	00	01	02	03	04
	[0.80, 0.90]	10	11	12	13	14
	[0.70, 0.80]	30	31	32	33	34
	[0.50, 0.70]	50	51	52	53	54
	< ←, 0.50]	70	71	72	73	84

Table A6.2: Criteria used for classification of data quality based on laboratory comparison results.

RB %	2RSD %	<0, 1*DQO]	<1*DQO - 2*DQO]	<2*DQO - 4*DQO]	<4*DQO, → >
	< ←, -40 >	80	81	82	83
	[-40, -20 >	60	61	62	63
	[-20, -10 >	40	41	42	43
	[-10, - 5 >	20	21	22	23
	[-5, +5]	00	01	02	03
	< 5, 10]	10	11	12	13
	< 10, 20]	30	31	32	33
	< 20, 40]	50	51	52	53
	< 40, → >	70	71	72	73