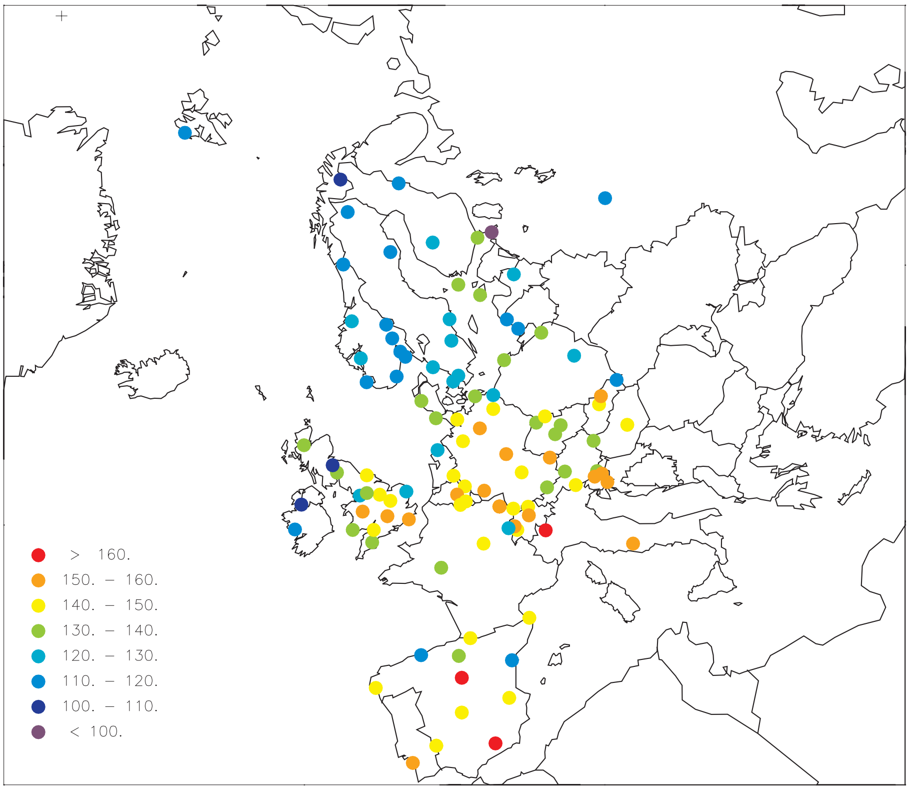
EMEP/CCC-Report 1/2001

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

Ozone measurements 1999

Anne-Gunn Hjellbrekke and Sverre Solberg



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1. Introduction

Ozone is a natural constituent of the atmosphere and plays a vital role in many atmospheric processes. However, man made emissions of volatile organic compounds and nitrogen oxides have increased the photochemical formation of ozone in the troposphere. Until the end of the 1960s the problem was basically believed to be one of the big cities and their immediate surroundings. In the 1970s, however, it was found that the problem of photochemical oxidant formation is much more wide-spread. The ongoing monitoring of ozone at rural sites throughout Europe shows that episodes of high concentrations of ground-level ozone occur over most parts of the continent every summer. During these episodes the ozone concentrations can reach values above ambient air quality standards over large regions and lead to adverse effects for human health and vegetation. Historical records of ozone measurements in Europe and North America indicate that in the last part of the nineteenth century the values were only about half of the average surface ozone concentrations measured in the same regions during the last 10-15 years (Bojkov, 1986; Volz and Kley, 1988).

The formation of ozone is due to a large number of photochemical reactions taking place in the atmosphere and depends on the temperature, humidity and solar radiation as well as the primary emissions of nitrogen oxides and volatile organic compounds. Together with the non-linear relationships between the primary emissions and the ozone formation, these effects complicates the abatement strategies for ground-level ozone and makes photochemical models crucial in addition to the monitoring data.

The 1999 Gothenburg Protocol is designed for a joint abatement of acidification, eutrophication and ground-level ozone. It has been estimated that once the Protocol is implemented, the number of days with excessive ozone levels will be halved and that the exposure of vegetation to excessive ozone levels will be 44% down on 1990.

2. Critical levels

Ozone concentrations vary widely from region to region, with the time of year, and with time of day. Typically, high concentrations of ozone are observed in periods with anticyclonic conditions. Such episodes may lead to adverse environmental effects such as impact on human health, agricultural crops, forests and materials. National authorities and international organisations have therefore formulated critical levels for ozone.

The critical levels defined by ECE for protection of vegetation are 150 $\mu g/m^3$ for hourly mean, 60 $\mu g/m^3$ for eight-hour mean and 50 $\mu g/m^3$ for seven-hour mean (9 a.m.–4 p.m.) averaged over the growing season (April–September). According to the EU ozone directive, the threshold values for protection of vegetation are 200 $\mu g/m^3$ for hourly mean and 65 $\mu g/m^3$ for daily mean, while the threshold value for health protection is 110 μg/m^3 for eight-hour mean. In addition information should be given to the population when hourly means exceed 180 μg/m^3 and a warning should be issued if hourly means exceed 360 μg/m^3.

The critical level formulated by WHO for protection of health is 120 μg/m^3 for eight-hour mean.

In defining the harmful effects of ozone exposure to plants, attention must be given to the physiological response to ozone. Ozone is generally taken up through the stomata, and reacts with a number of enzymes and antioxidants. Several studies have shown that plants respond by reduced carbon dioxide uptake, and other symptoms of damage to the respiration system, for ozone exposure above a certain threshold (e.g. Forberg et al., 1987). This concentration threshold varies between plant species, cultivars, and phenological development.

Previously recommended critical levels for ozone based on seven-hour mean concentrations in the growing season do not take into account the existence of such a threshold, and have been criticised because the effects on vegetation of a generally high concentration level of ozone may be less harmful than the exposure to short-term and episodic high concentrations, which may cause permanent damage to the cell tissue.

Within the framework of the UN-ECE Convention on long-range transboundary air pollution, workshops held at Egham, UK (Ashmore and Wilson, 1992) and at Bern, Switzerland (Führer and Achermann, 1994) have recommended that critical levels for ozone exposure should be based on the accumulated exposure in ppb hours over a concentration threshold during the growing season (AOT). The Egham workshop was not able to decide conclusively on the threshold concentration or the accumulated dose corresponding to the critical loads, but the Bern workshop made specific recommendations to use a threshold of 40 ppb. The critical levels were revised at a UN-ECE workshop in Kuopio, Finland (Kärenlampi and Skärby, 1996) with minor changes to the Bern recommendations and are defined as:

- Critical level for agricultural crops: The AOT40 for crops is calculated as an accumulated ozone exposure above a threshold of 40 ppb for a period of three months during daylight hours, defined as those hours the mean global radiation is 50 W/m^2 or greater. The AOT40 value for comparison with the critical level should be calculated as the highest running three months sum during the period when crops are grown. If a fixed period is required for modelling assessment the period May to July should be used. Data from open-top chamber experiments indicate that an AOT40 of 3000 ppbh corresponds to a 5% yield loss for wheat. This value is only applicable when soil moisture is not limiting because of sufficient precipitation or irrigation.

  Short term critical level for crops: The critical levels are defined as:
  - 500 ppbh over five days for high (water) vapour pressure deficit conditions
  - 200 ppbh over five days for low (water) vapour pressure deficit conditions.

  As for the long term critical level, the short term critical levels refer to daylight hours only and should not be applied when soil moisture is limiting.

- For natural vegetation, since the sensitivity of the most sensitive species is considered to be similar to that of the most sensitive crops, the same long term critical level as for agricultural crops is used.

- Critical level for forests: AOT40 of 10 000 ppbh, calculated for daylight hours only, defined as for crops, during a six months period from April to September.

Although these critical loads are based on relatively strong experimental evidence, changes in the formulations may be expected when more information is available on the response of different plants to ozone exposure. The vegetation periods above are defined as being typical of climatic conditions in northern Europe whereas other vegetation periods may be more appropriate for other areas, such as southern Europe and northern Scandinavia.

The critical levels are considered to be suitable for exceedance mapping and integrated assessment modelling, but should not be used for economic assessment of crop or biomass losses. For these purposes, it is needed to take into account different species and modifying factors such as (water) vapour pressure deficit, soil moisture content, nutritional status, altitude, other pollutants etc.

3. Measurement network

Surface ozone measurements have been a part of the EMEP extended (voluntary) measurement activities since the third phase (1 January 1984–31 December 1986). Due to the lack of funds, the systematic collection and checking of data within EMEP, did not start until 1 January 1987. The measurement of ozone data within the EMEP region was a continuation of the OECD's oxidant data collection programme OXIDATE. Ozone data from the OXIDATE project have been reported in three reports (Grennfelt and Schjoldager, 1987; Grennfelt et al., 1988 and 1989).

This report presents surface ozone data measured at rural and background EMEP sites during 1999 with emphasis on statistical summaries and geographical distributions. Earlier reports present ozone data from 1985 (Feister and Pedersen, 1989), 1986 (Feister et al., 1990), 1988 (Pedersen, 1992), 1989 (Pedersen and Kvalvågnes, 1993), 1990–1992 (Hjellbrekke, 1995), 1993-1994 (Hjellbrekke, 1996), 1995 (Hjellbrekke, 1997), 1996 (Hjellbrekke, 1998), 1997 (Hjellbrekke, 1999) and 1998 (Hjellbrekke, 2000).

Table 1 and Figure 1 show the location of the monitoring stations reporting data from whole or part of 1999. In total 107 stations in 25 different countries reported data. One of these sites (Ispra) is operated by the Commission of the European Communities in Italy. Measurements were stopped at four German sites during 1999: Meinerzhagen, Hohenwestedt, Wiesenburg and Murnauer Moos. A new site, Aukrug, located close to Hohenwestedt started measuring in July 1999. Belgium have started reporting data after many years absence, and data from three sites, Offagne, Vezin and Eupen, are included in this report. There are five new sites in Spain: Niembro, Campisabalos, Cabo de Creus, Barcarrola and Zarra, and one new site in Russia, Danki, located in the Moscow region.

Table 1: List of EMEP ozone monitoring stations in operation 1999.

Code	Station	Country	Latitude	Longitude	Altitude (m)
AT02	Illmitz	Austria	47 46 00 N	16 46 00 E	117
AT04	St.Koloman	Austria	47 39 00 N	13 12 00 E	851
AT05	Vorhegg	Austria	46 40 40 N	12 58 20 E	1020
BE01	Offagne	Belgium	49 52 40 N	05 12 13 E	430
BE32	Eupen	Belgium	50 37 46 N	06 00 10 E	295
BE35	Vezin	Belgium	50 30 12 N	04 59 22 E	160
CH02	Payerne	Switzerland	46 49 00 N	06 57 00 E	500
CH03	Taenikon	Switzerland	47 29 00 N	08 54 00 E	540
CH04	Chaumont	Switzerland	47 03 00 N	06 59 00 E	1130
CH05	Rigi	Switzerland	47 04 00 N	08 28 00 E	1028
CZ01	Svratouch	Czech Republic	49 44 00 N	16 02 00 E	737
CZ03	Kosetice	Czech Republic	49 35 00 N	15 05 00 E	633
DE01	Westerland	Germany	54 55 32 N	08 18 35 E	12
DE02	Waldhof	Germany	52 48 08 N	10 45 34 E	73
DE03	Schauinsland	Germany	47 54 53 N	07 54 31 E	1205
DE04	Deuselbach	Germany	49 45 53 N	07 03 07 E	480
DE05	Brotjacklriegel	Germany	48 49 10 N	13 13 09 E	1016
DE07	Neuglobsow	Germany	53 09 00 N	13 02 00 E	62
DE08	Schmücke	Germany	50 39 00 N	10 46 00 E	937
DE09	Zingst	Germany	54 26 00 N	12 44 00 E	1
DE12	Bassum	Germany	52 51 00 N	08 43 00 E	52
DE17	Ansbach	Germany	49 18 00 N	10 34 00 E	481
DE26	Ueckermünde	Germany	53 45 00 N	14 04 00 E	1
DE31	Wiesenburg	Germany	52 07 00 N	12 28 00 E	107
DE35	Lückendorf	Germany	50 50 00 N	14 46 00 E	490
DE38	Murnauer Moos	Germany	47 39 05 N	11 12 12 E	622
DE39	Aukrug	Germany	54 04 29 N	09 47 34 E	15
DK31	Ulborg	Denmark	56 17 00 N	08 26 00 E	10
DK32	Frederiksborg	Denmark	55 58 00 N	12 20 00 E	10
EE09	Lahemaa	Estonia	59 30 00 N	25 54 00 E	32
EE11	Vilsandi	Estonia	58 23 00 N	21 49 00 E	6
ES01	San Pablo	Spain	39 32 52 N	04 20 55 W	917
ES03	Tortosa	Spain	40 49 14 N	00 29 29 E	44
ES04	Logroño	Spain	42 27 28 N	02 30 11 W	445
ES05	Noia	Spain	42 43 41 N	08 55 25 W	683
ES07	Viznar	Spain	37 14 18 N	03 28 28 W	1230
ES08	Niembro	Spain	43 26 32 N	04 51 01 W	134
ES09	Campisabalos	Spain	41 16 52 N	03 08 34 W	1360
ES10	Cabo de Creus	Spain	42 19 10 N	03 19 01 E	23
ES11	Barcarrola	Spain	38 28 33 N	06 55 22 W	393
ES12	Zarra	Spain	39 05 10 W	01 06 07 W	885
FI09	Utö	Finland	59 47 00 N	21 23 00 E	7
FI17	Virolahti	Finland	60 31 00 N	27 41 00 E	8
FI22	Oulanka	Finland	66 19 00 N	29 25 00 E	310
FI37	Ähtäri II	Finland	62 35 00 N	24 11 00 E	180
FR08	Donon	France	48 30 00 N	07 08 00 E	775
FR09	Revin	France	49 54 00 N	04 38 00 E	390
FR10	Morvan	France	47 16 00 N	04 05 00 E	620
FR12	Iraty	France	43 02 00 N	01 05 00 W	1300
FR13	Peyrusse Vieille	France	43 22 00 N	02 06 00 E	200
FR14	Montandon	France	47 18 00 N	06 49 00 E	746
GB02	Eskdalemuir	United Kingdom	55 19 00 N	03 12 00 W	269
GB06	Lough Navar	United Kingdom	54 27 00 N	07 54 00 W	130
GB13	Yarner Wood	United Kingdom	50 36 00 N	03 42 00 W	119
GB14	High Muffles	United Kingdom	54 20 00 N	00 48 00 W	267
GB15	Strath Vaich	United Kingdom	57 44 00 N	04 47 00 W	270

Table 1, cont.

Code	Station	Country	Latitude	Longitude	Altitude (m)
GB31	Aston Hill	United Kingdom	52 30 00 N	03 20 00 W	370
GB32	Bottesford	United Kingdom	52 56 00 N	00 49 00 W	32
GB33	Bush	United Kingdom	55 52 00 N	03 12 00 W	180
GB34	Glazebury	United Kingdom	53 28 00 N	02 28 00 W	21
GB36	Harwell	United Kingdom	51 34 00 N	01 19 00 W	137
GB37	Ladybower	United Kingdom	53 20 00 N	01 45 00 W	420
GB38	Lullington Heath	United Kingdom	50 47 00 N	00 11 00 E	120
GB39	Sibton	United Kingdom	52 18 00 N	01 28 00 E	46
GB43	Narberth	United Kingdom	51 46 53 N	04 41 34 W	160
GB44	Somerton	United Kingdom	51 13 52 N	03 02 53 W	55
GB45	Wicken Fell	United Kingdom	52 17 54 N	00 17 34 W	5
GR01	Aliartos	Greece	38 22 00 N	23 05 00 E	110
GR02	Finokalia	Greece	35 19 00 N	25 40 00 E	0
HU02	K-puszta	Hungary	46 58 00 N	19 35 00 E	125
IE31	Mace Head	Ireland	53 10 00 N	09 30 00 W	15
IT01	Montelibretti	Italy	42 06 00 N	12 38 00 E	48
IT04	Ispra	Italy	45 48 00 N	08 38 00 E	209
LT15	Preila	Lithuania	55 21 00 N	21 04 00 E	5
LV10	Rucava	Latvia	56 13 00 N	21 13 00 E	18
NL09	Kollumerwaard	Netherlands	53 20 00 N	06 17 00 E	1
NL10	Vreedepeel	Netherlands	51 32 28 N	05 51 13 E	28
NO01	Birkenes	Norway	58 23 00 N	08 15 00 E	190
NO15	Tustervatn	Norway	65 50 00 N	13 55 00 E	439
NO39	Kårvatn	Norway	62 47 00 N	08 53 00 E	210
NO41	Osen	Norway	61 15 00 N	11 47 00 E	440
NO42	Spitsbergen, Zeppelin	Norway	78 54 00 N	11 53 00 E	474
NO43	Prestebakke	Norway	59 00 00 N	10 36 00 E	160
NO45	Jeløya	Norway	59 26 00 N	10 36 00 E	3
NO48	Voss	Norway	60 36 00 N	06 32 00 E	500
NO52	Sandve	Norway	59 12 00 N	05 12 00 E	15
NO55	Karasjok	Norway	69 28 00 N	25 13 00 E	333
NO56	Hurdal	Norway	60 22 00 N	11 04 00 E	300
PL02	Jarczew	Poland	51 19 00 N	21 59 00 E	180
PL03	Sniezka	Poland	50 44 00 N	15 44 00 E	1604
PL04	Leba	Poland	54 45 00 N	17 32 00 E	2
PL05	Diabla Gora	Poland	54 09 00 N	22 04 00 E	157
PT04	Monte Velho	Portugal	38 05 00 N	08 48 00 W	43
RU16	Shepeljovo	Russia	59 58 00 N	29 07 00 E	4
RU17	Danki	Russia	54 54 00 N	37 48 00 E	150
SE02	Rörvik	Sweden	57 25 00 N	11 56 00 E	10
SE11	Vavihill	Sweden	56 01 00 N	13 09 00 E	175
SE12	Aspvreten	Sweden	58 48 00 N	17 23 00 E	20
SE13	Esrange	Sweden	67 53 00 N	21 04 00 E	475
SE32	Norra Kvill	Sweden	57 49 00 N	15 34 00 E	261
SE35	Vindeln	Sweden	64 15 00 N	19 46 00 E	225
SI08	Iskrba	Slovenia	45 34 00 N	14 52 00 E	520
SI31	Zavodnje	Slovenia	46 25 43 N	15 00 12 E	770
SI32	Krvavec	Slovenia	46 17 58 N	14 32 19 E	1740
SI33	Kovk	Slovenia	46 07 43 N	15 06 50 E	600
SK02	Chopok	Slovakia	48 56 00 N	19 35 00 E	2008
SK04	Stará-Lesná	Slovakia	49 09 00 N	20 17 00 E	808
SK06	Starina	Slovakia	49 03 00 N	22 16 00 E	345

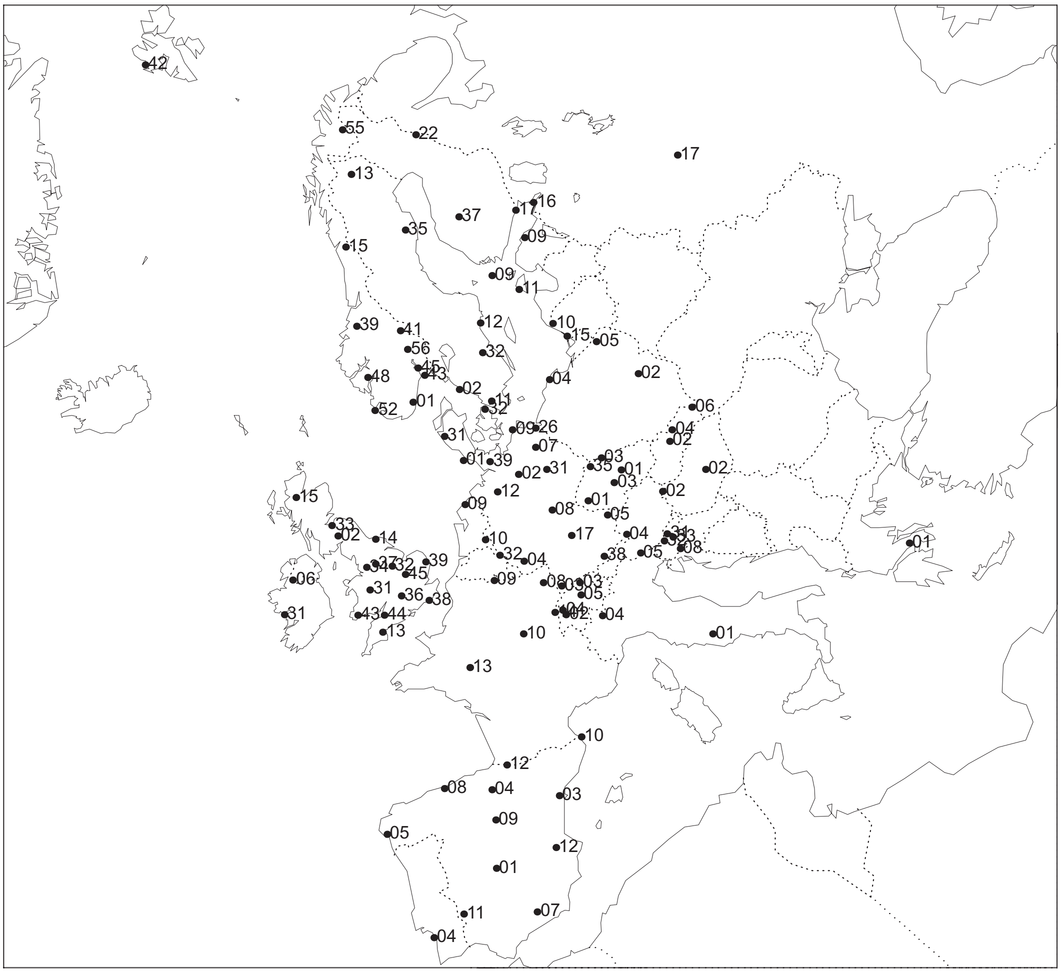

Figure 1: Location of the monitoring stations.

At Donon (FR08) the measurements are taken at four different heights above the ground:

FR08A: 8.6 m, ground level
FR08B: 17.6 m, half height of the trees
FR08C: 31.2 m, canopy of the trees
FR08D: 45.2 m, approximately 15 m above the trees

The ozone sites are situated mainly in central, western and northern Europe and the network density is insufficient in the eastern and Mediterranean parts of Europe.

The monitoring stations have been selected by the countries and only a small number of them are regular EMEP sites. Information about the ozone data quality, calibration and maintenance procedures have during 2000 been collected from the participants (Aas et al., 2000).

The UV-absorption method was the only measurement method in use in 1999.

All data presented in this report are given in µg/m^3. The conversion factor used to calculate from ppb to µg/m^3 is given in Table 2. Most countries use a conversion factor of 2.0, which corresponds to 20°C and 1013 hPa. Switzerland uses the mean annual conditions at the stations (9°C and 950 mbar at Payerne, Tänikon, Rigi, Chaumont and Sion). A number of countries report ozone data in ppb, and in this case the data are converted to µg/m^3 by multiplying by 2.0 at the CCC.

Table 2: Conversion factor ppb – µg/m^3.

Country	Conversion factor
Austria	2.0
Belgium	unknown
Czech Republic	2.0
Denmark	2.0
Estonia	2.14
Finland	2.0
France	2.0
Germany	2.0
Great Britain	reported in ppb
Greece	1.96
Hungary	2.0
Ireland (Mace Head)	reported in ppb
Italy (Ispra)	2.0
Italy (Montelibretti)	reported in ppb
Lithuania	2.0
Netherlands	2.0
Norway	2.0
Poland	2.0
Russia	2.0
Slovakia	reported in ppb
Slovenia	2.0
Spain	2.0
Sweden	2.0
Switzerland	1.96

4. Data completeness

The annual data capture (number of valid measurements in per cent of the total number of measurements) for each station is given in Table 3. The capture was in general good, and in 1999 as many as 83 stations had a capture above 90%. Not taking into account sites where the measurements started or ended during 1999, one site had a capture lower than 50%.

Table 3: Data capture in per cent, 1999.

Code	Station	Data capture 1999
AT02	Illmitz	95.6
AT04	Koloman	93.2
AT05	Vorhegg	95.1
BE01	Offagne	90.6
BE32	Eupen	92.2
BE35	Vezin	94.0
CH02	Payerne	99.5
CH03	Taenikon	99.6
CH04	Chaumont	96.3
CH05	Rigi	98.1
CZ01	Svratouch	99.2
CZ03	Kosetice	96.1
DE01	Westerland	94.5
DE02	Waldhof	97.5
DE03	Schauinsland	91.6
DE04	Deuselbach	61.4
DE05	Brotjacklriegel	93.5
DE07	Neuglobsow	94.8
DE08	Schmücke	95.6
DE09	Zingst	99.5
DE12	Bassum	89.2
DE17	Ansbach	88.9
DE26	Ueckermünde	94.4
DE31	Wiesenburg	15.2
DE35	Lückendorf	95.5
DE38	Murnauer Moos	38.0
DE39	Aukrug	94.5
DK31	Ulborg	98.0
DK32	Frederiksborg	98.4
EE09	Lahemaa	93.4
EE11	Vilsandi	89.6
ES01	San Pablo	91.0
ES03	Tortosa	94.6
ES04	Logroño	89.6
ES05	Noia	94.3
ES07	Viznar	94.3
ES08	Niembro	94.3
ES09	Campisabalos	91.9
ES10	Cabo de Creus	94.0
ES11	Barcarrola	77.8
ES12	Zarra	94.9
FI09	Uto	97.8
FI17	Virolahti	94.6
FI22	Oulanka	98.1
FI37	Ahtari II	96.4
FR08A	Donon	47.6
FR08B	Donon	47.7
FR08C	Donon	47.7
FR08D	Donon	47.7
FR09	Revin	79.5
FR10	Morvan	83.5
FR12	Iraty	76.1
FR13	Peyrusse Vieille	98.0
FR14	Montandon	95.9
FR13	Peyrusse Vieille	98.0
FR14	Montandon	95.9

Table 3, cont.

Code	Station	Data capture 1999
GB02	Eskdalemuir	95.5
GB06	Lough Navar	87.6
GB13	Yarner Wood	98.3
GB14	High Muffles	99.2
GB15	Strath Vaich	94.1
GB31	Aston Hill	99.1
GB32	Bottesford	95.5
GB33	Bush	96.8
GB34	Glazebury	94.4
GB36	Harwell	91.1
GB37	Ladybower	97.5
GB38	Lullington Heath	96.9
GB39	Sibton	95.1
GB43	Narberth	83.7
GB44	Somerton	98.8
GB45	Wicken Fen	95.4
GR01	Aliartos	81.6
GR02	Finokalia	73.0
HU02	K-puszta	92.4
IE31	Mace Head	99.7
IT01	Montelibretti	97.7
IT04	Ispra	98.1
LT15	Preila	81.4
LV10	Rucava	80.8
NL09	Kollumerwaard	99.7
NL10	Vredepeel	94.3
NO01	Birkenes	99.7
NO15	Tustervatn	99.9
NO39	Kaarvatn	99.9
NO41	Osen	99.8
NO42	Spitsbergen, Zeppelin	99.2
NO43	Prestebakke	99.4
NO45	Jeloya	99.6
NO48	Voss	99.7
NO52	Karmoy	99.8
NO55	Karasjok	96.8
NO56	Hurdal	99.7
PL02	Jarczew	97.9
PL03	Sniezka	98.2
PL04	Leba	98.7
PL05	Diabla Gora	98.5
PT04	Monte Velho	76.2
RU16	Shepeljovo	98.4
RU17	Danki	38.5
SE02	Rorvik	97.8
SE11	Vavihill	98.2
SE12	Aspvreten	91.8
SE13	Esrange	99.8
SE32	Norra Kvill	95.9
SE35	Vindeln	99.6
SI08	Iskrba	89.1
SI31	Zavodnje	87.4
SI32	Krvavec	88.7
SI33	Kovk	80.8
SK02	Chopok	62.0
SK04	Stara-Lesna	93.0
SK06	Starina	97.6

Missing data in the measurement series may be critical, especially in summer when the highest ozone concentrations occur. In particular calculations of AOT40 values may be strongly affected by missing data, and a correction is necessary in order to obtain comparable calculations. In the mapping of AOT40, a 85% data capture has been required and an adjustment proportional to the number of missing data has been applied, i.e. exposure index divided by the fraction of data available. This correction will give a good approximation when the missing data are randomly scattered throughout the dataset, but a better correction is needed for larger gaps in the dataset. Calculations of percentiles are less sensitive to missing data, and a data capture of 75% has been regarded as sufficient for the mapping.

5. Concentration summaries and episodes

Table 1.1 in Annex 1 shows the extreme concentrations for 1999. The number of hours and days the ozone concentrations exceed 120, 150, 200 and 240 μg/m^3 and the maxima are given. The highest hourly mean values was found at the two Italian sites Montelibretti (268 μg/m^3, 2 June) and Ispra (221 μg/m^3, 6 July). Values above 200 μg/m^3 were measured at five British sites (Bottesford, Harwell, Ladybower, Lullington Heath and Somerton) and at the Portuguese site Monte Velho, The lowest maximum values were observed in Norway, at Karasjok (112 μg/m^3, 27 April) and Spitsbergen, Zeppelin (122 μg/m^3, 9 May).

The one hour critical level for ozone formulated by the ECE for protection of vegetation, 150 μg/m^3, was in 1999 exceeded at 81 sites. In the central parts of Europe the exceedances were considerable, and at Ispra this limit was exceeded 186 days during 1999.

Table 1.2 shows the 25-, 50-, 75-, 90-, 95-, 98- and 99-percentiles for the period April–September. Graphical distributions of the 99-percentile and 95-percentile are shown in Figure 1.1 and Figure 1.2. The lowest values are found in Ireland, Norway and northern Sweden and Finland, where the 99-percentile is below 120 μg/m^3. Low concentrations are also measured in Latvia and Lithuania. The concentrations are higher in central Europe and England, where the 99-percentile generally ranges from 150-160 μg/m^3. At two Spanish sites and Ispra the 99-percentile reaches above 160 μg/m^3. The concentration levels on the Iberian peninsula are inconsistent, possibly due to local influence and topographical differences.

6. Calculation of AOT40

According to the workshop on critical levels for ozone in Europe, held in Kuopio, 1996, the AOT40 values for forest and agricultural crops is accumulated during daylight hours only, defined as hours with mean global radiation exceeding 50 W/m^2. Since the CCC has no access to measurements of global radiation, an algorithm estimating the radiation has been used in the calculations of AOT40. The algorithm calculates the zenith angle given time, latitude and longitude, and uses results from a radiation model (Dahlback, 1991) to estimate the visible fraction (400-700 nm) of global radiation assuming a clear sky. Comparison with measurements shows that the model gives good estimates of the solar radiation with an inaccuracy in the magnitude of a few per cent. The total global radiation is approximately 40% higher than the visible fraction, but this will have only small influence on the calculation of AOT40 except for stations far north, since the global radiation increases above 50 W/m^2 only a short time after sunrise.

AOT40 and AOT60 for forests and agricultural crops for 1999 are shown in Tables 2.1 and 2.2 in Annex 2, and the corresponding geographical distributions of AOT40 and AOT60 in Figures 2.1-2.4. The maps of AOT40 show a general increasing gradient from west to east. The lowest values are found in Scandinavia, in the Baltic region and in the northern parts of Ireland and the United Kingdom, while the highest values are found in Spain, Slovenia, Slovakia and Italy and Hungary.

The maps show that the exceedances of the critical levels are considerable. The critical level for forests (10 000 ppbh) is exceeded in larger parts of central and Eastern Europe. Several stations in central Europe had AOT40 values above 20 000 ppbh. The critical level for agricultural crops, 3000 ppbh, was in 1999 exceeded at most stations except a few sites in Scandinavia, Ireland, United Kingdom and the Baltic states.

To give an indication of the exceedances of short-time AOT40, the number of days contained in at least one five-day period where the AOT40 exceeds the critical level of 500 ppbh in 1999 is shown in Table 2.3. The exceedances were numerous, especially in central and southern Europe, reaching 213 days at Viznar, 187 days at Cabo de Creus and 184 days at Krvavec during 1999. Most of the exceedances occurred in the period April-September.

7. Seasonal variation

Monthly mean concentrations for 1999 are given in Table 3.1 in Annex 3 and monthly data capture in Table 3.2. The concentrations show a clear pattern with maximum values during spring or early summer and a minimum in winter. The seasonal variations is the net result of a number of processes such as dry deposition, photochemical loss (titration with NO_x) and formation, and varying influx from the stratosphere as well as varying background ozone concentrations.

Plots of the seasonal variations 1990–1999 are given in Figure 3.1.

The seasonal variation of ozone shows characteristics which seem to be bound by the geographical location of the station (Roemer et al., 1996). In central and Alpine Europe the variation is characterised by a broad summer maximum with high monthly means from May to August. A springtime maximum in April and May followed by a gradual decline to a minimum in November-December is found for sites in England, the Netherlands and the southern parts of Scandinavia and Finland. A springtime maximum followed by a minimum in the summer is generally found in Ireland, Scotland and the northern parts of Scandinavia and Finland.

8. Diurnal variation

In addition to the seasonal variation, ozone concentrations show a variation on a shorter time scale. The diurnal variation is a result of the variation in vertical mixing, surface dry deposition and photochemistry. Thus, coastal and mountain sites away from NO_x sources generally show the least diurnal cycles, whereas diurnal cycles will be most pronounced at inland sites in spring and summer.

The average diurnal variation of surface ozone for summer (April–September) 1999 is shown in Annex 4. In general the lowest concentrations are found in early morning and the highest in the afternoon.

The most pronounced diurnal variation is found at the rural sites in central Europe e.g. sites in Switzerland, most of the German sites and Ispra in Italy. Typical for those sites is a more marked peak in the diurnal cycle with a characteristic maximum around mid-afternoon. The pronounced diurnal peak during the summer months is due to photochemical generation of ozone during daytime as a result of higher temperature and insolation during this time of the day. However, during the night, more stable atmospheric conditions and nocturnal inversions prevent the vertical mixing and the transport of ozone from the free troposphere into the boundary layer.

A weaker diurnal variation is observed at the coastal and island stations and at the remote sites in Norway and Sweden. Mace Head, situated on the west coast of Ireland, has roughly the same average concentrations as the rural sites in central Europe but almost no diurnal variation due to remoteness from source areas and prevailing westerly winds. Zeppelinfjellet at Spitsbergen shows no diurnal variation.

Elevated sites like Schauinsland, Chaumont and Krvavec show a weaker diurnal cycle and the average concentration level is also high, due to influence of air from the free troposphere.

9. Update

The data compiled in this report represent the quality assured and quality controlled data at present. If errors are detected in the future, the data will be corrected in the database. It is important that users make certain they have access to the most recent version of the data. For the data presented here, the latest alteration was 29 March, 2001.

Complete data sets are available upon request to the CCC (e-mail: anne-gunn.hjellbrekke@nilu.no). Information about the EMEP network and measurement data is also available on the web at http://www.emep.int and http://www.nilu.no/projects/ccc/index.html.

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Annex 1

Concentration summaries and episodes, tables and figures

Table 1.1: Number of hours (h) and days (d) exceeding 120, 150, 200 and 240 µg/m³ and maximum concentrations in 1999.

Code	Station	Total		>120		>150		>200		>240		Max concentration	
		hours	days	hours	days	hours	days	hours	days	hours	days	µg/m³	date
AT02	Illmitz	8377	365	318	78	6	5	0	0	0	0	156	2. 7.99
AT04	Koloman	8160	359	421	57	12	4	0	0	0	0	163	20. 7.99
AT05	Vorhegg	8327	365	333	51	39	10	0	0	0	0	190	21. 7.99
BE01	Offagne	7940	353	260	45	40	10	0	0	0	0	189	17. 6.99
BE32	Eupen	8080	355	246	41	34	9	0	0	0	0	196	17. 6.99
BE35	Vezin	8238	356	222	37	50	15	0	0	0	0	180	4. 8.99
CH02	Payerne	8717	365	262	50	18	7	0	0	0	0	160	2. 8.99
CH03	Taenikon	8729	365	260	58	28	11	0	0	0	0	177	11. 9.99
CH04	Chaumont	8439	359	684	68	63	17	0	0	0	0	164	2. 8.99
CH05	Rigi	8592	361	634	80	55	16	0	0	0	0	176	27. 7.99
CZ01	Svratouch	8687	365	321	45	2	1	0	0	0	0	152	1. 5.99
CZ03	Kosetice	8422	353	216	39	0	0	0	0	0	0	149	26. 6.99
DE01	Westerland	8282	357	158	31	9	4	0	0	0	0	165	5. 8.99
DE02	Waldhof	8538	365	318	50	64	12	0	0	0	0	177	28. 5.99
DE03	Schauinsland	8020	354	587	65	36	12	0	0	0	0	163	27. 5.99
DE04	Deuselbach	5381	251	414	53	47	14	0	0	0	0	175	19. 7.99
DE05	Brotjacklriegel	8191	358	638	80	43	11	0	0	0	0	172	26. 6.99
DE07	Neuglobsow	8306	364	319	53	34	9	0	0	0	0	178	28. 5.99
DE08	Schmücke	8378	365	761	66	99	19	0	0	0	0	176	19. 7.99
DE09	Zingst	8714	365	130	26	6	3	0	0	0	0	165	27. 5.99
DE12	Bassum	7818	344	157	26	39	9	0	0	0	0	184	4. 8.99
DE17	Ansbach	7784	344	190	40	19	6	0	0	0	0	166	4. 8.99
DE26	Ueckermünde	8273	363	81	19	0	0	0	0	0	0	145	5. 7.99
DE31	Wiesenburg	1334	58	0	0	0	0	0	0	0	0	89	27. 2.99
DE35	Lückendorf	8363	365	259	40	6	2	0	0	0	0	161	15. 9.99
DE38	Murnauer Moos	3327	140	97	25	0	0	0	0	0	0	149	3. 4.99
DE39	Aukrug	8276	364	216	39	42	10	0	0	0	0	188	4. 4.99
DK31	Ulborg	8587	362	124	22	9	6	0	0	0	0	167	20. 7.99
DK32	Frederiksborg	8618	364	47	11	1	1	0	0	0	0	155	6. 8.99

Table 1.1, cont.

Code	Station	Total		>120		>150		>200		>240		Max concentration	
		hours	days	hours	days	hours	days	hours	days	hours	days	µg/m³	date
EE09	Lahemaa	8183	346	119	27	6	1	0	0	0	0	163	17. 4.99
EE11	Vilsandi	7846	356	400	57	4	1	0	0	0	0	151	11. 6.99
ES01	San Pablo	7975	358	490	49	13	6	0	0	0	0	161	18. 6.99
ES03	Tortosa	8291	365	39	15	0	0	0	0	0	0	140	29. 7.99
ES04	Logroño	7852	350	156	35	8	3	0	0	0	0	170	16. 6.99
ES05	Noia	8261	363	272	36	38	8	0	0	0	0	191	8. 7.99
ES07	Viznar	8260	364	1467	151	164	45	0	0	0	0	181	15. 6.99
ES08	Niembro	8264	364	37	10	3	2	0	0	0	0	164	24. 6.99
ES09	Campisabalos	8054	365	617	79	117	26	0	0	0	0	194	25. 7.99
ES10	Cabo de Creus	8236	365	432	73	19	7	0	0	0	0	167	3. 9.99
ES11	Barcarrola	6811	303	246	35	15	4	0	0	0	0	199	9. 7.99
ES12	Zarra	8317	365	448	94	11	6	0	0	0	0	163	25. 6.99
FI09	Uto	8564	361	197	34	2	1	0	0	0	0	162	13. 6.99
FI17	Virolahti	8288	350	202	32	8	1	0	0	0	0	175	20. 4.99
FI22	Oulanka	8591	363	16	2	0	0	0	0	0	0	144	21. 4.99
FI37	Ahtari II	8445	364	72	10	0	0	0	0	0	0	148	20. 4.99
FR08A	Donon	4172	180	421	51	51	13	0	0	0	0	184	1. 6.99
FR08B	Donon	4178	180	470	52	54	11	0	0	0	0	184	1. 6.99
FR08C	Donon	4180	180	484	54	59	11	0	0	0	0	185	1. 6.99
FR08D	Donon	4178	180	516	57	70	14	0	0	0	0	184	1. 6.99
FR09	Revin	6963	296	217	36	19	6	0	0	0	0	175	17. 6.99
FR10	Morvan	7315	327	200	28	18	5	0	0	0	0	168	2. 8.99
FR12	Iraty	6665	294	348	51	21	8	0	0	0	0	168	25. 6.99
FR13	Peyrusse Vieille	8583	361	156	25	8	3	0	0	0	0	179	2. 7.99
FR14	Montandon	8401	362	48	13	0	0	0	0	0	0	137	30. 7.99
GB02	Eskdalemuir	8364	352	74	12	18	5	0	0	0	0	180	2. 8.99
GB06	Lough Navar	7672	324	5	2	0	0	0	0	0	0	132	30. 7.99
GB13	Yarner Wood	8615	363	132	25	16	7	0	0	0	0	186	30. 7.99
GB14	High Muffles	8686	365	158	22	36	4	0	0	0	0	188	2. 8.99
GB15	Strath Vaich	8245	348	103	10	15	3	0	0	0	0	176	2. 8.99

Table 1.1, cont.

Code	Station	Total		>120		>150		>200		>240		Max concentration	
		hours	days	hours	days	hours	days	hours	days	hours	days	μg/m^3	date
GB31	Aston Hill	8678	365	136	16	51	8	0	0	0	0	196	31. 7.99
GB32	Bottesford	8363	361	105	16	40	8	1	1	0	0	206	1. 8.99
GB33	Bush	8483	359	21	6	0	0	0	0	0	0	136	27. 7.99
GB34	Glazebury	8261	355	51	10	18	3	0	0	0	0	176	1. 8.99
GB36	Harwell	7981	338	137	22	44	9	2	1	0	0	206	1. 8.99
GB37	Ladybower	8538	364	105	17	23	4	1	1	0	0	208	1. 8.99
GB38	Lullington Heath	8488	362	172	26	59	10	4	2	0	0	222	31. 7.99
GB39	Sibton	8334	354	41	13	6	2	0	0	0	0	184	2. 8.99
GB43	Narberth	7329	316	94	14	15	5	0	0	0	0	186	30. 7.99
GB44	Somerton	8655	365	130	24	32	9	1	1	0	0	216	30. 7.99
GB45	Wicken Fen	8357	356	132	25	38	8	0	0	0	0	190	1. 8.99
GR01	Aliartos	7149	308	349	74	2	2	0	0	0	0	161	17. 9.99
GR02	Finokalia	6393	303	1716	148	84	22	0	0	0	0	178	23. 7.99
HU02	K-puszta	8093	349	563	96	25	9	0	0	0	0	183	30. 6.99
IE31	Mace Head	8734	365	8	4	0	0	0	0	0	0	138	26. 6.99
IT01	Montelibretti	8556	360	355	101	73	38	13	8	3	3	268	2. 6.99
IT04	Ispra	8597	365	558	108	186	49	9	5	0	0	221	6. 7.99
LT15	Preila	7132	310	22	5	0	0	0	0	0	0	146	27. 3.99
LV10	Rucava	7076	306	10	4	0	0	0	0	0	0	133	8. 9.99
NL09	Kollumerwaard	8727	365	66	15	13	4	0	0	0	0	165	4. 8.99
NL10	Vredepeel	8087	354	139	32	41	12	0	0	0	0	196	4. 8.99
NO01	Birkenes	8734	365	33	9	0	0	0	0	0	0	146	3. 4.99
NO15	Tustervatn	8752	365	14	7	0	0	0	0	0	0	131	3. 8.99
NO39	Kaarvatn	8755	365	65	11	0	0	0	0	0	0	146	21. 5.99
NO41	Osen	8744	365	13	5	0	0	0	0	0	0	127	10. 4.99
NO42	Spitsbergen,Zepp.	8684	364	1	1	0	0	0	0	0	0	122	9. 5.99
NO43	Prestebakke	8704	365	23	8	1	1	0	0	0	0	154	28. 5.99
NO45	Jeloya	8726	365	20	7	0	0	0	0	0	0	142	28. 5.99
NO48	Voss	8738	365	50	12	0	0	0	0	0	0	141	21. 5.99

Table 1.1, cont.

Code	Station	Total		>120		>150		>200		>240		Max concentration	
		hours	days	hours	days	hours	days	hours	days	hours	days	µg/m^3	date
NO52	Karmoy	8742	365	42	10	0	0	0	0	0	0	137	20. 5.99
NO55	Karasjok	8480	357	0	0	0	0	0	0	0	0	112	27. 4.99
NO56	Hurdal	8735	365	4	2	0	0	0	0	0	0	132	21. 5.99
PL02	Jarczew	8574	364	68	17	0	0	0	0	0	0	148	7. 8.99
PL03	Sniezka	8604	364	704	85	11	7	0	0	0	0	158	15. 9.99
PL04	Leba	8648	365	153	30	11	3	0	0	0	0	164	28. 5.99
PL05	Diabla Gora	8626	365	185	34	14	4	0	0	0	0	162	7. 8.99
PT04	Monte Velho	6678	284	167	29	36	8	1	1	0	0	210	19. 6.99
RU16	Shepeljovo	8624	365	5	3	0	0	0	0	0	0	139	27. 8.99
RU17	Danki	3370	147	12	3	3	1	0	0	0	0	155	13. 7.99
SE02	Rorvik	8571	361	76	21	5	1	0	0	0	0	159	28. 5.99
SE11	Vavihill	8600	362	67	13	5	1	0	0	0	0	165	6. 8.99
SE12	Aspvreten	8046	344	83	20	0	0	0	0	0	0	144	20. 6.99
SE13	Esrange	8746	365	8	1	0	0	0	0	0	0	131	27. 4.99
SE32	Norra Kvill	8403	356	85	18	2	2	0	0	0	0	155	6. 8.99
SE35	Vindeln	8726	365	5	2	0	0	0	0	0	0	138	21. 4.99
SI08	Iskrba	7808	355	312	51	46	9	0	0	0	0	173	6. 8.99
SI31	Zavodnje	7653	359	167	24	16	4	0	0	0	0	170	2. 6.99
SI32	Krvavec	7768	353	1023	116	79	18	0	0	0	0	182	15. 9.99
SI33	Kovk	7074	336	421	63	45	11	0	0	0	0	176	20. 7.99
SK02	Chopok	5434	238	692	70	8	3	0	0	0	0	179	27. 6.99
SK04	Stara-Lesna	8144	358	726	95	60	17	0	0	0	0	168	1. 4.99
SK06	Starina	8554	365	37	13	0	0	0	0	0	0	147	1. 3.99

Table 1.2: Percentiles of hourly ozone values April–September 1999.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
AT02	Illmitz	58.0	77.0	98.0	116.0	124.0	134.0	140.0	95.6
AT04	Koloman	78.0	94.0	108.0	120.0	129.0	136.0	140.4	92.5
AT05	Vorhegg	63.0	81.0	99.0	114.2	127.0	140.0	150.0	94.9
BE01	Offagne	57.0	73.0	93.0	112.0	126.7	141.9	150.0	91.2
BE32	Eupen	47.0	65.0	86.0	109.0	123.0	136.0	147.0	94.2
BE35	Vezin	33.0	55.0	77.0	102.0	123.0	142.0	153.8	96.2
CH02	Payerne	41.0	67.0	91.0	111.0	124.0	136.0	143.3	99.5
CH03	Taenikon	44.0	67.0	89.0	110.0	123.0	134.0	144.0	99.6
CH04	Chaumont	82.0	96.0	111.0	129.0	139.0	149.0	152.0	95.0
CH05	Rigi	80.0	95.0	111.0	126.0	136.0	146.0	153.0	98.2
CZ01	Svratouch	72.0	87.0	103.0	116.0	124.0	129.0	134.0	98.9
CZ03	Kosetice	61.0	80.0	98.0	111.0	121.0	130.0	134.3	92.6
DE01	Westerland	70.0	85.0	96.0	108.0	117.0	129.0	136.0	94.4
DE02	Waldhof	46.0	69.0	92.0	114.0	130.0	146.0	156.0	96.8
DE03	Schauinsland	83.0	96.0	111.0	126.0	135.0	145.0	150.0	94.3
DE04	Deuselbach	65.0	81.0	101.0	122.1	134.0	146.0	152.0	84.9
DE05	Brotjacklriegel	82.0	100.0	114.0	125.0	134.0	144.0	151.0	93.5
DE07	Neuglobsow	47.0	72.0	93.0	116.0	127.0	142.0	148.0	95.6
DE08	Schmücke	76.0	92.0	112.2	131.0	139.0	152.0	158.0	95.8
DE09	Zingst	61.0	76.0	90.0	103.0	113.0	126.3	136.0	99.8
DE12	Bassum	41.0	58.0	78.0	100.0	115.0	132.6	150.0	93.9
DE17	Ansbach	41.0	62.0	85.0	106.0	120.0	132.0	143.0	91.5
DE26	Ueckermünde	52.0	68.0	82.0	96.0	107.0	120.0	125.0	95.3
DE35	Lückendorf	61.0	80.0	98.0	113.0	122.0	133.0	138.0	95.4
DE38	Murnauer Moos	53.8	81.0	100.2	113.0	122.2	131.0	137.0	27.2
DE39	Aukrug	41.0	64.0	85.0	106.0	121.0	140.0	150.8	93.8
DK31	Ulborg	59.0	71.5	87.0	100.0	112.0	125.0	134.0	98.4
DK32	Frederiksborg	45.0	61.0	76.0	91.0	98.0	110.5	121.0	98.5
EE09	Lahemaa	49.0	71.0	90.0	105.0	113.0	122.0	128.0	96.7
EE11	Vilsandi	78.0	91.0	107.0	119.0	127.0	134.0	139.0	90.3
ES01	San Pablo	78.0	91.0	105.0	123.0	132.0	141.0	145.0	94.0
ES03	Tortosa	44.0	60.0	73.0	93.0	105.0	115.0	120.0	94.6
ES04	Logroño	54.0	73.0	92.0	108.0	117.0	128.8	136.0	90.2
ES05	Noia	71.0	82.0	93.0	111.0	125.0	141.0	148.4	94.8
ES07	Viznar	91.0	109.0	124.0	139.0	148.0	157.1	164.0	95.6
ES08	Niembro	57.0	70.0	83.0	95.0	102.0	111.0	118.0	94.2
ES09	Campisabalos	69.0	88.0	108.0	131.0	142.0	155.0	161.0	89.8
ES10	Cabo de Creus	85.0	98.0	109.0	120.0	129.0	138.0	145.0	94.4
ES11	Barcarrola	51.0	72.0	92.0	110.0	124.0	136.0	142.0	93.0
ES12	Zarra	81.0	95.0	109.0	121.0	129.0	139.0	143.0	94.4
FI09	Uto	75.0	88.0	100.0	112.0	119.0	128.0	134.3	99.4
FI17	Virolahti	64.0	83.0	99.0	112.0	120.0	129.0	135.0	90.1
FI22	Oulanka	47.0	60.0	81.0	96.0	103.0	108.0	113.0	99.5
FI37	Ahtari II	53.0	73.0	91.0	105.0	113.0	119.0	124.0	93.3
FR08A	Donon	75.0	89.0	106.0	124.0	135.0	146.0	155.7	80.4
FR08B	Donon	77.0	91.0	108.0	126.0	136.0	147.3	156.0	80.5
FR08C	Donon	79.0	92.0	109.0	126.1	137.0	148.2	157.0	80.6
FR08D	Donon	80.0	93.0	110.0	128.0	138.0	150.0	158.0	80.5
FR09	Revin	54.0	71.0	90.0	108.0	121.0	135.0	144.0	91.5
FR10	Morvan	65.0	79.0	93.0	107.0	121.0	134.0	146.0	88.8
FR12	Iraty	85.2	100.0	112.0	123.0	131.0	143.4	148.2	61.0
FR13	Peyrusse Vieille	57.0	71.0	87.0	105.0	116.0	127.9	134.5	96.8
FR14	Montandon	49.0	66.0	81.0	94.0	103.0	113.0	122.0	95.6
GB02	Eskdalemuir	42.0	58.0	74.0	88.0	98.0	118.0	132.3	93.0
GB06	Lough Navar	34.0	50.0	68.0	82.0	88.0	96.9	104.0	98.5
GB13	Yarner Wood	46.0	62.0	82.0	96.0	110.1	130.0	140.0	97.9
GB14	High Muffles	50.0	66.0	82.0	100.0	114.0	134.0	148.0	99.6
GB15	Strath Vaich	60.0	70.0	84.0	98.0	108.0	126.0	140.0	93.7
GB31	Aston Hill	56.0	66.0	80.0	92.0	106.0	134.0	152.0	98.6

Table 1.2, cont.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
GB32	Bottesford	36.0	54.0	74.0	88.0	100.0	128.0	150.0	94.1
GB33	Bush	44.0	58.0	74.0	86.0	92.0	102.0	110.0	94.1
GB34	Glazebury	20.0	44.0	62.0	78.0	88.0	106.0	128.8	92.4
GB36	Harwell	42.0	58.0	76.0	94.0	112.0	142.0	154.7	83.4
GB37	Ladybower	46.0	60.0	78.0	90.0	102.0	124.0	138.0	96.7
GB38	Lullington Heath	54.0	68.0	86.0	102.0	116.0	138.0	158.0	98.3
GB39	Sibton	42.0	60.0	74.0	90.0	100.0	114.0	121.8	91.3
GB43	Narberth	52.0	64.0	76.0	90.0	101.3	124.0	140.0	97.6
GB44	Somerton	46.0	62.0	78.0	94.0	109.7	128.0	144.0	98.9
GB45	Wicken Fen	30.0	52.0	72.0	92.0	106.0	130.0	146.0	97.9
GR01	Aliartos	34.0	72.0	104.0	120.0	128.0	135.0	139.0	79.8
GR02	Finokalia	108.0	118.0	130.0	138.0	144.0	152.0	156.0	83.1
HU02	K-puszta	56.0	78.0	105.0	125.0	133.0	141.8	148.0	94.7
IE31	Mace Head	58.0	70.0	84.0	98.0	106.0	112.0	114.0	99.7
IT01	Montelibretti	19.5	49.0	91.0	115.4	129.0	146.0	160.0	99.0
IT04	Ispra	22.0	58.0	93.0	127.0	146.0	169.0	182.0	98.5
LT15	Preila	58.0	70.0	83.0	94.0	101.0	111.0	114.0	72.9
LV10	Rucava	46.0	61.0	75.0	88.0	97.0	107.0	112.3	65.3
NL09	Kollumerwaard	42.0	63.0	79.0	91.0	101.0	115.0	128.1	99.9
NL10	Vredepeel	29.0	49.0	72.0	95.0	112.0	136.0	150.0	94.2
NO01	Birkenes	46.0	64.0	80.0	96.0	104.0	112.0	118.0	99.6
NO15	Tustervatn	57.0	72.0	93.0	103.0	107.0	111.0	114.0	99.9
NO39	Kaarvatn	37.0	61.0	85.0	101.0	109.0	118.0	125.0	99.9
NO41	Osen	42.0	62.0	79.0	94.0	102.0	110.0	115.0	99.9
NO42	Spitsbergen,Zepp.	48.0	60.0	78.0	96.0	102.0	108.0	111.0	98.4
NO43	Prestebakke	48.0	62.0	76.0	90.0	100.0	110.0	116.0	99.5
NO45	Jeloya	54.0	68.0	82.0	94.0	100.0	108.0	116.0	99.5
NO48	Voss	49.0	67.0	85.0	96.0	105.0	117.0	121.0	99.7
NO52	Karmoy	60.2	72.0	86.0	98.0	104.0	112.5	120.0	99.7
NO55	Karasjok	50.0	62.0	78.0	92.0	96.0	102.0	104.0	93.7
NO56	Hurdal	42.0	58.0	72.0	88.0	96.0	108.0	112.0	99.7
PL02	Jarczew	42.0	61.0	83.0	100.0	110.0	118.0	123.0	96.8
PL03	Sniezka	86.0	101.0	114.0	126.0	134.0	142.0	146.0	99.6
PL04	Leba	63.0	78.0	93.0	107.0	115.0	129.0	138.0	98.8
PL05	Diabla Gora	52.0	74.0	93.0	108.0	116.0	128.4	135.0	98.6
PT04	Monte Velho	41.0	65.0	84.0	106.0	121.5	137.0	154.9	68.4
RU16	Shepeljovo	57.0	65.0	72.0	80.0	86.0	92.0	96.0	97.7
RU17	Danki	26.0	44.0	64.0	82.0	94.0	105.0	113.3	35.7
SE02	Rorvik	56.0	72.0	86.0	99.0	109.0	119.0	127.0	99.4
SE11	Vavihill	55.0	69.0	84.0	98.0	106.0	117.0	127.0	99.7
SE12	Aspvreten	60.0	76.0	89.5	104.0	111.0	120.0	124.0	97.3
SE13	Esrange	52.0	67.0	86.0	100.0	104.0	108.0	113.0	99.9
SE32	Norra Kvill	63.0	75.0	90.0	104.0	111.0	120.0	125.0	98.1
SE35	Vindeln	42.0	59.0	79.0	93.0	100.0	104.3	111.0	99.8
SI08	Iskrba	25.0	70.0	97.0	116.0	125.0	141.3	153.0	88.4
SI31	Zavodnje	65.0	80.0	95.0	109.0	118.0	131.0	137.0	87.4
SI32	Krvavec	100.0	109.0	120.0	132.0	140.0	150.0	156.0	87.2
SI33	Kovk	73.0	91.0	108.0	122.0	131.0	144.0	152.0	85.0
SK02	Chopok	77.0	102.0	117.0	126.0	132.0	137.0	141.0	81.9
SK04	Stara-Lesna	47.0	78.0	107.0	128.0	137.0	146.0	152.0	93.3
SK06	Starina	48.0	65.0	82.0	96.0	104.0	112.0	117.1	97.6

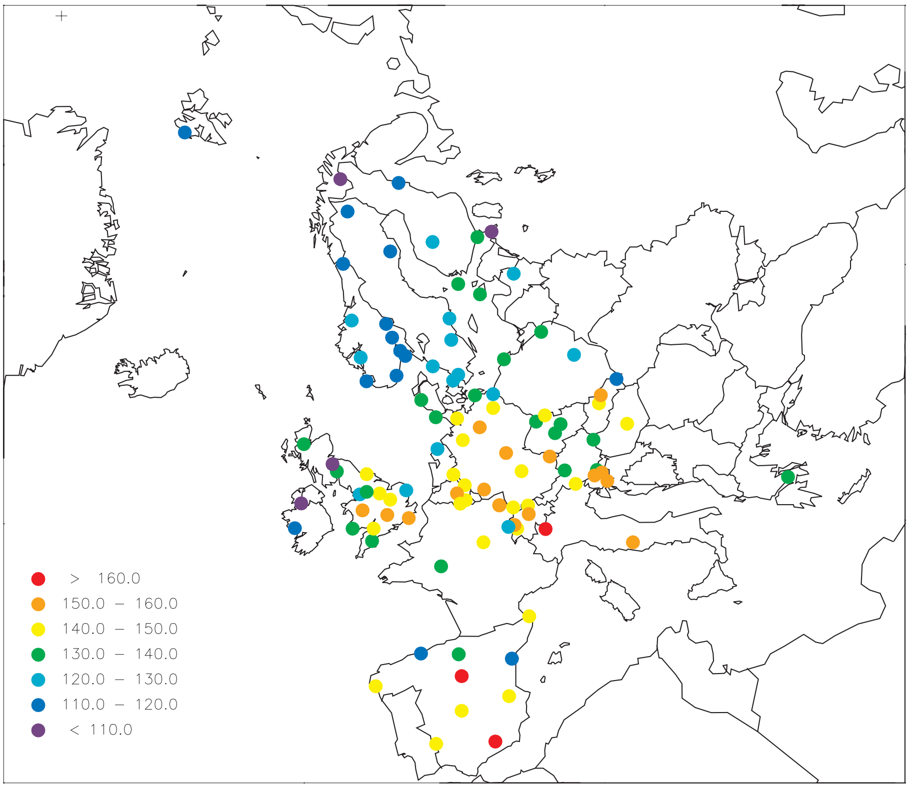


Figure 1.1: Ozone April–September 1999. 99-percentiles (µg/m^3).

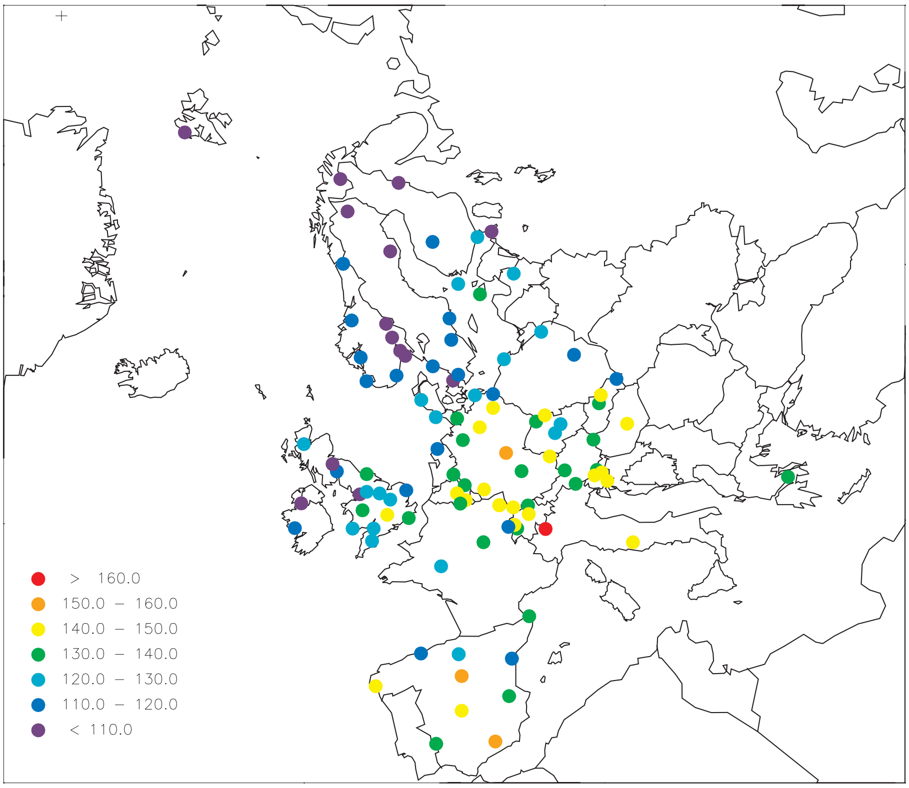


Figure 1.2: Ozone April–September 1999. 95-percentiles (µg/m^3).

Annex 2

AOT40 and AOT60, figures and tables

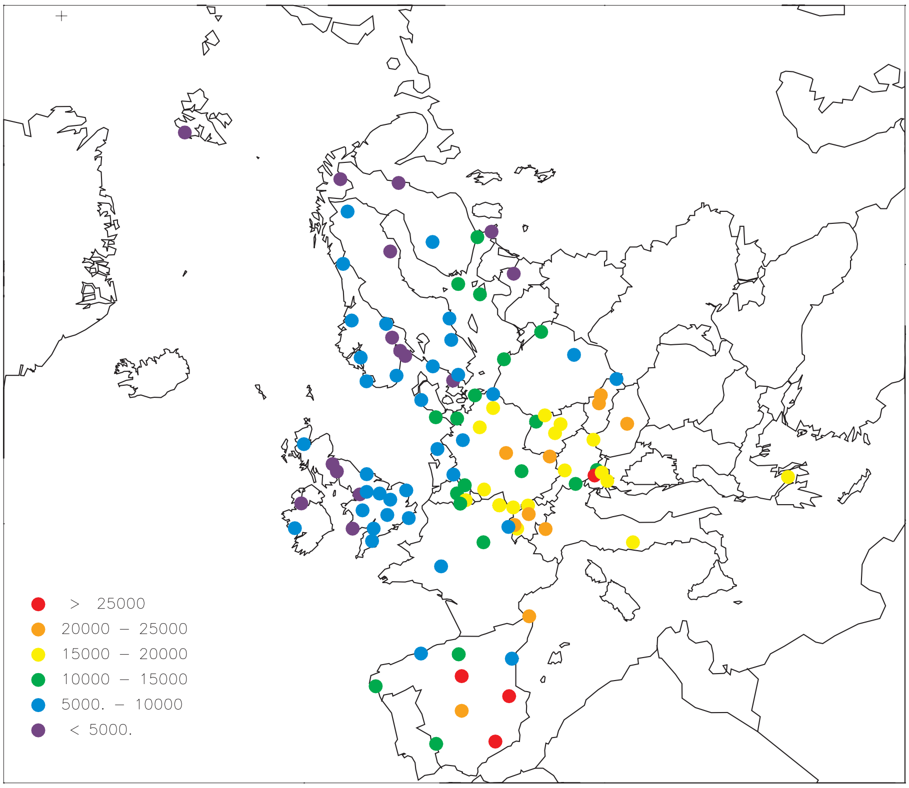


Figure 2.1: AOT40 (ppbh) April–September 1999 (daylight hours).

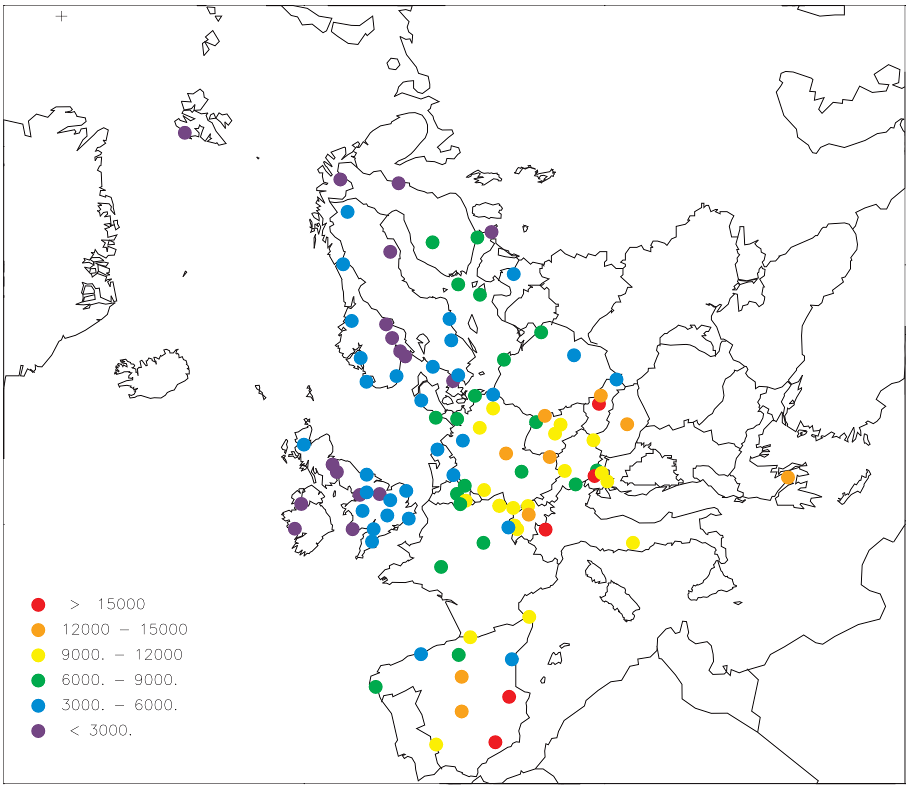


Figure 2.2: AOT40 (ppbh) May, June and July 1999 (daylight hours).

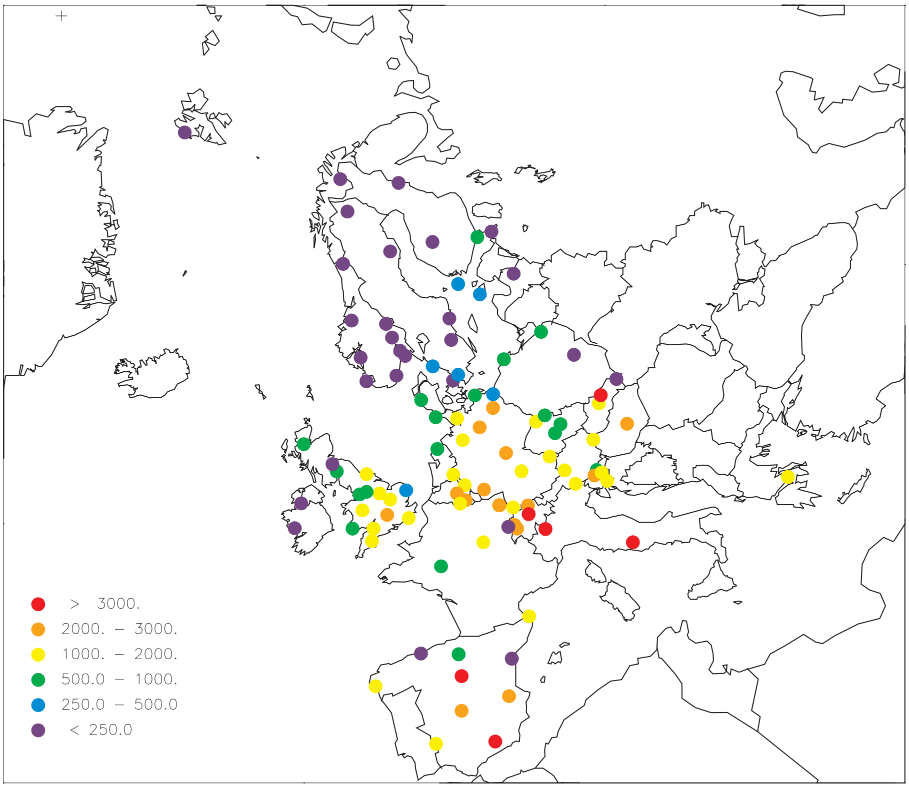


Figure 2.3: AOT60 (ppbh) April-September 1999 (daylight hours).

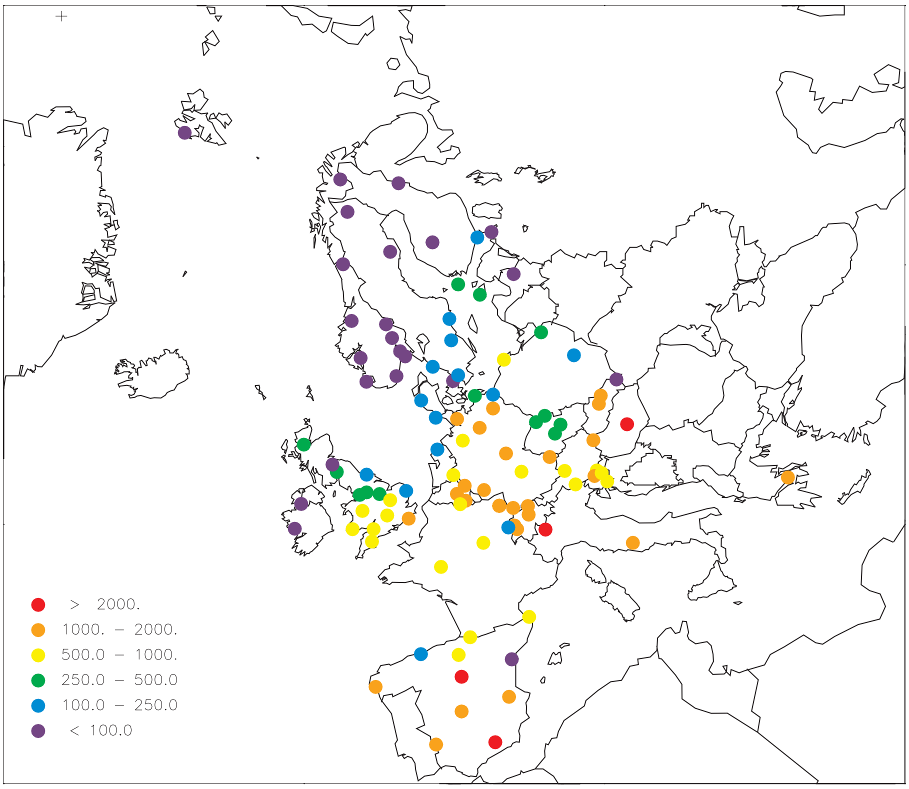


Figure 2.4: AOT60 (ppbh) May, June and July 1999 (daylight hours).

Table 2.1: AOT40 and AOT60 April–September 1999 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT02	Illmitz	15985	16837	1418	1494	94.9
AT04	Koloman	14122	15613	916	1013	90.4
AT05	Vorhegg	12544	13857	1023	1130	90.5
BE32	Eupen	11442	12335	1643	1771	92.8
BE35	Vezin	10852	11367	2149	2251	95.5
BE01	Offagne	14154	15584	2104	2316	90.8
CH02	Payerne	16418	16606	2039	2062	98.9
CH03	Taenikon	15591	15692	2078	2091	99.4
CH04	Chaumont	20530	21716	2390	2528	94.5
CH05	Rigi	21456	21897	3125	3189	98.0
CZ01	Svratouch	16118	16308	766	775	98.8
CZ03	Kosetice	15127	16075	843	896	94.1
DE01	Westerland	11838	12736	649	698	92.9
DE02	Waldhof	15696	16007	2622	2673	98.1
DE03	Schauinsland	18168	19296	1700	1805	94.1
DE04	Deuselbach	15450	17847	2252	2602	86.6
DE05	Brotjacklriegel	20184	21343	1648	1743	94.6
DE07	Neuglobsow	15999	16791	2235	2346	95.3
DE08	Schmücke	19926	20828	2868	2998	95.7
DE09	Zingst	10417	10462	682	684	99.6
DE12	Bassum	8616	9275	1424	1533	92.9
DE17	Ansbach	11954	13046	1324	1444	91.6
DE26	Ueckermünde	7296	7631	292	306	95.6
DE35	Lückendorf	13650	14407	1043	1101	94.7
DE38	Murnauer Moos	5204	19655	330	1246	26.5
DE39	Aukrug	11745	12604	1802	1934	93.2
DK31	Ulborg	8710	8862	612	622	98.3
DK32	Frederiksborg	4332	4408	196	200	98.3
EE09	Lahemaa	4767	4966	25	26	96.0
EE11	Vilsandi	11502	12350	315	338	93.1
ES01	San Pablo	19706	20033	2025	2059	98.4
ES03	Tortosa	5978	6080	96	98	98.3
ES04	Logroño	13892	14819	916	977	93.7
ES05	Noia	10866	10974	1330	1343	99.0
ES07	Viznar	36248	36448	7813	7856	99.5
ES08	Niembro	5968	6094	187	191	97.9
ES09	Campisabalos	26257	27947	5343	5687	94.0
ES10	Cabo de Creus	23172	23427	1607	1625	98.9
ES11	Barcarrola	14544	14997	1470	1515	97.0
ES12	Zarra	24992	25479	2120	2161	98.1
FI09	Uto	12617	12733	441	445	99.1
FI17	Virolahti	11988	13326	489	544	90.0
FI22	Oulanka	4656	4687	72	72	99.3
FI37	Ahtari II	9243	9827	148	157	94.1
FR08	Donon	12698	15430	1330	1617	82.3
FR08	Donon	14604	17682	1689	2045	82.6
FR08	Donon	15078	18235	1754	2122	82.7
FR08	Donon	15668	18972	1852	2242	82.6
FR09	Revin	11058	12107	1222	1338	91.3
FR10	Morvan	12130	13119	1178	1275	92.5
FR12	Iraty	11946	18451	770	1189	64.7
FR13	Peyrusse Vieille	9091	9401	724	748	96.7
FR14	Montandon	5852	6216	172	182	94.1
GB02	Eskdalemuir	4421	4761	620	668	92.9
GB06	Lough Navar	1957	1990	17	17	98.3
GB13	Yarner Wood	7819	8043	1072	1103	97.2
GB14	High Muffles	7712	7772	1114	1123	99.2
GB15	Strath Vaich	6169	6607	691	740	93.4
GB31	Aston Hill	5492	5648	1066	1096	97.2

Table 2.1, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
GB32	Bottesford	5899	6081	1353	1395	97.0
GB33	Bush	2414	2566	51	54	94.1
GB34	Glazebury	3047	3303	679	736	92.2
GB36	Harwell	7287	8681	1735	2067	83.9
GB37	Ladybower	5474	5719	956	999	95.7
GB38	Lullington Heath	9297	9565	1608	1654	97.2
GB39	Sibton	4667	5092	337	368	91.7
GB43	Narberth	4384	4538	651	674	96.6
GB44	Somerton	7976	8110	1306	1328	98.4
GB45	Wicken Fen	7178	7373	1393	1431	97.4
GR01	Aliartos	15438	19362	1513	1897	79.7
GR02	Finokalia	33365	40775	5174	6323	81.8
HU02	K-puszta	22195	23479	2836	3000	94.5
IE31	Mace Head	5121	5151	15	15	99.4
IT01	Montelibretti	18592	18760	3506	3538	99.1
IT04	Ispra	24056	24478	6989	7111	98.3
LT15	Preila	2802	3949	70	98	71.0
LV10	Rucava	2122	3330	15	24	63.7
NL09	Kollumerwaard	5950	5965	524	526	99.8
NL10	Vredepeel	8278	8781	1502	1593	94.3
NO01	Birkenes	6606	6657	161	162	99.2
NO15	Tustervatn	7753	7772	6	7	99.8
NO39	Kaarvatn	7940	7951	176	176	99.9
NO41	Osen	5092	5102	20	20	99.8
NO42	Spitsbergen, Zepp.	3305	3356	0	0	98.5
NO43	Prestebakke	4505	4531	54	54	99.4
NO45	Jeloya	4646	4684	64	65	99.2
NO48	Voss	6298	6325	93	93	99.6
NO52	Karmoy	6094	6138	80	81	99.3
NO55	Karasjok	2660	2790	0	0	95.3
NO56	Hurdal	3574	3591	8	8	99.5
PL02	Jarczew	8247	8608	226	236	95.8
PL03	Sniezka	19520	19624	812	816	99.5
PL04	Leba	11580	11693	791	799	99.0
PL05	Diabla Gora	11749	11902	695	704	98.7
PT04	Monte Velho	7664	11071	1272	1837	69.2
RU16	Shepeljovo	1360	1403	26	27	96.9
RU17	Danki	769	2167	50	142	35.5
SE02	Rorvik	8485	8539	344	347	99.4
SE11	Vavihill	6772	6808	334	336	99.5
SE12	Aspvreten	8284	8485	184	188	97.6
SE13	Esrange	5383	5396	16	16	99.8
SE32	Norra Kvill	8768	8941	232	237	98.1
SE35	Vindeln	4643	4654	20	20	99.8
SI08	Iskrba	15787	17036	1581	1706	92.7
SI31	Zavodnje	9192	10125	702	773	90.8
SI32	Krvavec	25952	28835	2175	2417	90.0
SI33	Kovk	16638	18466	1563	1735	90.1
SK02	Chopok	17169	20627	1058	1271	83.2
SK04	Stara-Lesna	22459	23933	3192	3402	93.8
SK06	Starina	7190	7295	56	57	98.6

Table 2.2: AOT40 and AOT60 May–July 1999 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT02	Illmitz	9754	10208	1002	1049	95.5
AT04	Koloman	8444	9295	697	767	90.8
AT05	Vorhegg	7213	7960	829	915	90.6
BE32	Eupen	6865	7143	1004	1045	96.1
BE35	Vezin	6924	7164	1500	1552	96.6
BE01	Offagne	8910	9351	1295	1359	95.3
CH02	Payerne	9679	9785	1117	1129	98.9
CH03	Taenikon	9204	9263	1377	1385	99.4
CH04	Chaumont	11074	11778	1204	1280	94.0
CH05	Rigi	12267	12390	1919	1938	99.0
CZ01	Svratouch	9264	9304	330	331	99.6
CZ03	Kosetice	9437	9454	472	472	99.8
DE01	Westerland	6148	6349	182	188	96.8
DE02	Waldhof	9366	9586	1556	1593	97.7
DE03	Schauinsland	10538	11405	1076	1165	92.4
DE04	Deuselbach	9230	10345	1400	1569	89.2
DE05	Brotjacklriegel	12494	12837	1302	1338	97.3
DE07	Neuglobsow	9506	9994	1388	1459	95.1
DE08	Schmücke	12246	12807	1514	1583	95.6
DE09	Zingst	6225	6230	380	381	99.9
DE12	Bassum	4990	5454	860	939	91.5
DE17	Ansbach	6464	6798	564	593	95.1
DE26	Ueckermünde	4316	4552	123	130	94.8
DE35	Lückendorf	7278	7709	321	340	94.4
DE38	Murnauer Moos	1996	9602	143	688	20.8
DE39	Aukrug	6936	7501	954	1032	92.5
DK31	Ulborg	4640	4673	228	230	99.3
DK32	Frederiksborg	2640	2649	96	96	99.7
EE09	Lahemaa	3291	3361	17	18	97.9
EE11	Vilsandi	8438	8870	247	260	95.1
ES01	San Pablo	14056	14293	1944	1976	98.3
ES03	Tortosa	3464	3487	77	78	99.3
ES04	Logroño	8002	8524	674	718	93.9
ES05	Noia	6612	6643	1043	1048	99.5
ES07	Viznar	22302	22512	5620	5672	99.1
ES08	Niembro	3300	3337	107	108	98.9
ES09	Campisabalos	13686	14779	3086	3332	92.6
ES10	Cabo de Creus	11918	11995	854	860	99.4
ES11	Barcarrola	9638	10013	1333	1385	96.3
ES12	Zarra	15350	15695	1744	1783	97.8
FI09	Uto	7104	7219	333	338	98.4
FI17	Virolahti	7840	8132	207	215	96.4
FI22	Oulanka	2224	2237	0	1	99.4
FI37	Ahtari II	5942	6077	62	63	97.8
FR08	Donon	9300	9873	1218	1292	94.2
FR08	Donon	10586	11163	1510	1593	94.8
FR08	Donon	10924	11530	1572	1660	94.7
FR08	Donon	11286	11935	1645	1740	94.6
FR09	Revin	7174	7347	922	944	97.6
FR10	Morvan	6630	6842	674	696	96.9
FR12	Iraty	8355	9723	743	865	85.9
FR13	Peyrusse Vieille	6220	6473	684	711	96.1
FR14	Montandon	3296	3452	126	132	95.5
GB02	Eskdalemuir	2608	2732	280	293	95.5
GB06	Lough Navar	1332	1360	17	17	97.9
GB13	Yarner Wood	5132	5333	858	892	96.2
GB14	High Muffles	3541	3559	215	216	99.5
GB15	Strath Vaich	3655	3931	335	360	93.0
GB31	Aston Hill	2870	3002	654	684	95.6
GB32	Bottesford	2888	2926	444	450	98.7

Table 2.2, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
GB33	Bush	1614	1625	38	38	99.3
GB34	Glazebury	1470	1588	262	283	92.6
GB36	Harwell	4515	4700	888	924	96.1
GB37	Ladybower	3002	3102	452	467	96.8
GB38	Lullington Heath	5696	5913	1091	1133	96.3
GB39	Sibton	3106	3141	210	212	98.9
GB43	Narberth	2578	2642	508	521	97.6
GB44	Somerton	4944	4984	839	846	99.2
GB45	Wicken Fen	3990	4071	764	780	98.0
GR01	Aliartos	10206	12320	1115	1346	82.8
GR02	Finokalia	18952	23077	3512	4277	82.1
HU02	K-puszta	13105	14037	2044	2189	93.4
IE31	Mace Head	2923	2954	8	8	98.9
IT01	Montelibretti	10656	10755	1964	1982	99.1
IT04	Ispra	15871	16286	5211	5347	97.5
LT15	Preila	1454	2816	0	0	51.6
LV10	Rucava	1730	2394	0	1	72.2
NL09	Kollumerwaard	3078	3078	170	170	100.0
NL10	Vredepeel	5012	5382	756	811	93.1
NO01	Birkenes	3531	3564	34	34	99.1
NO15	Tustervatn	4299	4317	6	6	99.6
NO39	Kaarvatn	4168	4178	40	40	99.8
NO41	Osen	2862	2867	2	3	99.8
NO42	Spitsbergen, Zepp.	2441	2476	0	0	98.6
NO43	Prestebakke	2633	2654	45	45	99.2
NO45	Jeloya	2856	2891	46	47	98.8
NO48	Voss	3457	3463	77	77	99.8
NO52	Karmoy	3224	3241	64	64	99.5
NO55	Karasjok	1203	1207	0	0	99.7
NO56	Hurdal	2202	2202	0	0	100.0
PL02	Jarczew	4978	5089	98	101	97.8
PL03	Sniezka	12064	12149	429	432	99.3
PL04	Leba	7578	7578	514	514	100.0
PL05	Diabla Gora	7281	7354	282	285	99.0
PT04	Monte Velho	6402	8838	1236	1705	72.4
RU16	Shepeljovo	635	650	0	0	97.7
RU17	Danki	697	3180	50	230	21.9
SE02	Rorvik	5190	5218	188	189	99.5
SE11	Vavihill	3522	3540	128	129	99.5
SE12	Aspvreten	5420	5433	152	153	99.7
SE13	Esrange	3040	3040	0	0	100.0
SE32	Norra Kvill	5806	5970	146	150	97.3
SE35	Vindeln	2836	2836	2	2	100.0
SI08	Iskrba	8280	9066	832	911	91.3
SI31	Zavodnje	5966	6497	612	666	91.8
SI32	Krvavec	14955	16449	1533	1686	90.9
SI33	Kovk	9093	9826	771	833	92.5
SK02	Chopok	13110	15810	912	1100	82.9
SK04	Stara-Lesna	11598	12254	1522	1609	94.7
SK06	Starina	4016	4046	35	35	99.3

Table 2.3: Number of days in 1999 contained in at least one five-day period with short-time AOT40 exceeding the critical level of 500 ppbh.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
AT02	Illmitz	0	0	1	16	17	23	26	10	10	0	0	0	103
AT04	Koloman	0	0	2	25	9	14	23	10	0	0	0	0	83
AT05	Vorhegg	0	4	6	26	8	17	20	9	0	0	0	0	90
BE01	Offagne	0	0	0	3	17	21	22	15	12	0	0	0	90
BE32	Eupen	0	0	3	4	9	16	22	8	11	0	0	0	73
BE35	Vezin	0	0	0	0	7	16	25	8	11	0	0	0	67
CH02	Payerne	0	0	1	7	16	24	25	9	14	0	0	0	96
CH03	Taenikon	0	0	0	15	14	27	26	9	13	0	0	0	104
CH04	Chaumont	0	0	7	27	15	25	27	21	18	0	0	0	140
CH05	Rigi	0	0	2	23	21	26	31	16	14	0	0	0	133
CZ01	Svratouch	0	0	3	18	21	15	20	18	14	0	0	0	109
CZ03	Kosetice	0	0	3	20	21	18	28	18	0	0	0	0	108
DE01	Westerland	0	0	0	0	16	9	3	11	13	0	0	0	52
DE02	Waldhof	0	0	3	6	22	15	26	10	14	0	0	0	96
DE03	Schauinsland	0	0	1	19	19	25	25	7	14	0	0	0	110
DE04	Deuselbach	0	0	0	5	16	24	27	15	14	0	0	0	101
DE05	Brotjacklriegel	0	0	2	26	29	28	26	17	9	0	0	0	137
DE07	Neuglobsow	0	0	2	16	29	3	22	11	12	0	0	0	95
DE08	Schmücke	0	0	3	10	23	29	28	16	16	0	0	0	125
DE09	Zingst	0	0	2	5	17	9	7	10	9	0	0	0	59
DE12	Bassum	0	0	0	0	6	0	20	9	8	0	0	0	43
DE17	Ansbach	0	0	0	0	8	12	23	13	14	0	0	0	70
DE26	Ueckermünde	0	0	0	0	15	1	7	10	0	0	0	0	33
DE31	Wiesenburg	0	0	0	0	0	0	0	0	0	0	0	0	0
DE35	Lückendorf	0	0	2	12	21	8	20	17	16	0	0	0	96
DE38	Murnauer Moos	0	5	3	28	18	0	0	0	0	0	0	0	54
DE39	Aukrug	0	0	4	8	21	2	2	10	0	0	0	0	47
DK31	Ulborg	0	0	2	7	15	0	0	8	5	0	0	0	37
DK32	Frederiksborg	0	0	0	0	6	0	0	8	0	0	0	0	14
EE09	Lahemaa	0	0	0	0	11	9	0	6	0	0	0	0	26
EE11	Vilsandi	0	0	8	16	27	30	18	8	8	0	0	0	115
ES01	San Pablo	0	0	0	11	8	25	31	12	0	0	0	0	87
ES03	Tortosa	0	0	0	0	0	0	24	2	8	0	0	0	34
ES04	Logroño	0	0	7	14	8	20	21	12	13	0	0	0	95
ES05	Noia	0	0	0	0	0	0	27	6	11	0	0	0	44
ES07	Viznar	0	8	29	30	31	30	31	27	22	5	0	0	213
ES08	Niembro	0	0	0	0	0	0	7	0	5	0	0	0	12
ES09	Campisabalos	0	0	6	22	4	22	31	30	19	2	0	0	136
ES10	Cabo de Creus	0	0	25	30	26	29	29	27	21	0	0	0	187
ES11	Barcarrola	0	0	0	0	0	24	31	11	9	0	0	0	75
ES12	Zarra	0	0	12	30	29	30	31	30	13	0	0	0	175
FI09	Uto	0	0	0	0	3	26	19	19	10	0	0	0	77
FI17	Virolahti	0	0	0	13	15	28	15	7	0	0	0	0	78
FI22	Oulanka	0	0	0	13	0	3	3	0	0	0	0	0	19
FI37	Ahtari II	0	0	0	15	16	25	3	0	0	0	0	0	59
FR08A	Donon	0	0	0	4	15	27	22	6	0	0	0	0	74
FR08B	Donon	0	0	0	6	15	28	23	7	0	0	0	0	79
FR08C	Donon	0	0	0	6	15	28	24	7	0	0	0	0	80
FR08D	Donon	0	0	0	6	15	28	24	7	0	0	0	0	80
FR09	Revin	0	0	0	3	13	20	16	2	11	0	0	0	65
FR10	Morvan	0	0	0	3	11	17	9	12	16	0	0	0	68
FR12	Iraty	0	0	5	28	12	21	24	3	0	0	0	0	93
FR13	Peyrusse Vieill	0	0	0	0	0	20	24	6	13	0	0	0	63
FR14	Montandon	0	0	0	0	0	6	3	3	9	0	0	0	21
GB02	Eskdalemuir	0	0	0	0	7	6	5	6	0	0	0	0	24
GB06	Lough Navar	0	0	0	0	0	0	0	0	0	0	0	0	0
GB13	Yarner Wood	0	0	0	2	6	7	17	3	8	0	0	0	43
GB14	High Muffles	0	0	0	0	9	0	5	8	7	0	0	0	29
GB15	Strath Vaich	0	0	0	0	11	8	5	8	0	0	0	0	32
GB31	Aston Hill	0	0	0	0	0	0	6	5	7	0	0	0	18
GB32	Bottesford	0	0	0	0	0	0	5	7	7	0	0	0	19
GB33	Bush	0	0	0	0	0	0	0	0	0	0	0	0	0
GB34	Glazebury	0	0	0	0	0	0	5	5	6	0	0	0	16

Table 2.3, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
GB36	Harwell	0	0	0	2	5	7	6	6	8	0	0	0	34
GB37	Ladybower	0	0	0	0	0	8	5	5	8	0	0	0	26
GB38	Lullington Heat	0	0	0	0	7	17	7	5	5	0	0	0	41
GB39	Sibton	0	0	0	0	0	0	3	3	0	0	0	0	6
GB43	Narberth	0	0	0	0	0	7	6	3	7	0	0	0	23
GB44	Somerton	0	0	0	2	5	7	13	5	8	0	0	0	40
GB45	Wicken Fen	0	0	0	0	0	8	6	6	7	0	0	0	27
GR01	Aliartos	0	0	0	7	29	26	15	11	0	0	0	0	88
GR02	Finokalia	0	6	22	30	31	30	30	30	30	7	0	0	216
HU02	K-puszta	0	0	9	27	31	27	28	25	13	0	0	0	160
IE31	Mace Head	0	0	0	1	13	0	0	0	0	0	0	0	14
IT01	Montelibretti	0	0	0	0	10	30	21	30	0	0	0	0	91
IT04	Ispra	0	0	4	24	27	30	31	17	16	0	0	0	149
LT15	Preila	0	0	0	0	0	0	0	7	0	0	0	0	7
LV10	Rucava	0	0	0	0	0	0	0	0	0	0	0	0	0
NL09	Kollumerwaard	0	0	0	0	0	0	3	8	5	0	0	0	16
NL10	Vredepeel	0	0	0	0	6	8	15	7	11	0	0	0	47
NO01	Birkenes	0	0	0	7	16	0	0	6	0	0	0	0	29
NO15	Tustervatn	0	0	1	26	23	4	1	0	0	0	0	0	55
NO39	Kaarvatn	0	0	0	14	25	0	0	0	0	0	0	0	39
NO41	Osen	0	0	0	6	9	0	0	0	0	0	0	0	15
NO42	Spitsbergen,Zep	0	0	0	0	19	0	0	0	0	0	0	0	19
NO43	Prestebakke	0	0	0	0	7	0	1	5	0	0	0	0	13
NO45	Jeloya	0	0	0	0	0	0	0	5	0	0	0	0	5
NO48	Voss	0	0	0	11	18	5	0	0	0	0	0	0	34
NO52	Karmoy	0	0	0	6	15	0	0	5	0	0	0	0	26
NO55	Karasjok	0	0	0	5	0	0	0	0	0	0	0	0	5
NO56	Hurdal	0	0	0	0	5	0	0	0	0	0	0	0	5
PL02	Jarczew	0	0	3	4	5	5	7	8	0	0	0	0	32
PL03	Sniezka	0	0	3	18	31	30	23	20	15	0	0	0	140
PL04	Leba	0	0	0	0	25	17	13	9	7	0	0	0	71
PL05	Diabla Gora	0	0	11	10	25	16	8	9	5	0	0	0	84
PT04	Monte Velho	0	0	0	0	0	19	13	0	0	0	0	0	32
RU16	Shepeljovo	0	0	0	0	0	0	0	0	0	0	0	0	0
RU17	Danki	0	0	0	0	0	0	0	0	0	0	0	0	0
SE02	Rorvik	0	0	0	7	15	5	3	9	0	0	0	0	39
SE11	Vavihill	0	0	0	5	8	0	0	8	0	0	0	0	21
SE12	Aspvreten	0	0	0	6	10	20	0	5	0	0	0	0	41
SE13	Esrange	0	0	0	13	11	0	0	0	0	0	0	0	24
SE32	Norra Kvill	0	0	0	8	11	22	1	7	0	0	0	0	49
SE35	Vindeln	0	0	0	0	0	0	0	0	0	0	0	0	0
SI08	Iskrba	0	5	7	30	23	18	19	10	6	0	0	0	118
SI31	Zavodnje	0	0	1	7	10	17	7	0	0	0	0	0	42
SI32	Krvavec	0	5	18	30	31	28	31	26	15	0	0	0	184
SI33	Kovk	0	0	2	26	12	22	30	11	12	0	0	0	115
SK02	Chopok	0	0	0	22	31	29	17	0	0	0	0	0	99
SK04	Stara-Lesna	0	0	17	30	31	23	9	16	20	0	0	0	146
SK06	Starina	0	0	8	15	22	0	0	0	0	0	0	0	45

Annex 3

Seasonal variation

Table 3.1: Monthly mean concentrations 1999 (μg/m3).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT02	Illmitz	31.8	63.0	66.9	86.2	82.5	84.9	80.3	68.8	61.1	43.0	34.1	38.8
AT04	Koloman	74.9	79.9	85.2	102.9	93.3	93.4	97.8	86.8	83.7	64.1	53.7	73.4
AT05	Vorhegg	71.7	85.5	88.1	95.7	78.8	84.7	87.4	73.7	70.0	54.4	54.3	68.3
BE01	Offagne	48.1	37.3	54.3	72.0	80.1	78.7	79.0	72.6	71.2	45.4	35.7	54.5
BE32	Eupen	50.6	47.5	56.7	68.5	68.6	68.2	71.5	62.0	64.5	42.7	30.3	43.8
BE35	Vezin	38.7	38.9	48.0	55.0	57.1	61.0	63.6	54.4	51.5	32.5	22.1	36.3
CH02	Payerne	32.3	51.6	56.2	72.9	64.0	74.2	72.1	59.9	57.2	24.3	23.9	42.3
CH03	Taenikon	38.4	52.1	54.9	75.5	69.7	72.7	72.3	58.6	58.6	29.7	25.1	48.7
CH04	Chaumont	72.1	74.6	88.2	98.6	93.5	100.3	102.0	96.7	95.3	60.5	59.3	68.6
CH05	Rigi	74.3	79.3	83.3	100.1	97.9	96.6	99.0	91.8	92.6	55.8	53.1	72.1
CZ01	Svratouch	51.6	67.8	74.3	86.7	96.9	82.0	89.2	86.8	81.8	49.3	40.4	51.2
CZ03	Kosetice	48.4	66.1	68.9	80.6	89.5	77.2	82.3	78.3	61.1	46.7	36.8	53.5
DE01	Westerland	51.7	70.9	66.6	82.4	87.1	86.8	80.7	87.6	75.5	57.1	46.0	61.8
DE02	Waldhof	36.4	51.7	56.6	69.9	75.8	67.2	76.0	68.2	66.2	36.3	24.0	44.5
DE03	Schauinsland	72.1	73.2	84.8	97.3	101.2	100.2	98.6	92.6	95.8	61.0	64.1	71.0
DE04	Deuselbach	57.2	64.3	-	81.7	84.7	86.6	87.4	81.0	85.3	-	-	-
DE05	Brotjacklriegel	67.8	65.7	77.3	103.8	105.1	100.7	99.2	93.6	87.3	60.0	51.6	60.8
DE07	Neuglobsow	32.9	51.8	51.5	71.5	87.3	65.3	72.3	68.3	63.7	34.7	20.7	36.3
DE08	Schmücke	49.5	60.2	71.7	86.4	103.1	98.5	94.9	90.3	94.6	53.6	40.7	54.1
DE09	Zingst	41.0	54.4	61.5	77.0	85.2	77.8	75.4	73.4	65.4	45.0	32.3	43.6
DE12	Bassum	35.4	45.3	49.6	61.4	66.2	55.8	70.6	62.4	55.4	30.6	-	40.3
DE17	Ansbach	33.2	46.7	48.2	61.1	66.7	62.2	65.6	64.6	64.2	-	20.7	43.1
DE26	Ueckermünde	41.5	51.0	59.0	66.0	77.1	70.6	69.7	65.2	59.3	39.5	29.8	37.8
DE31	Wiesenburg	33.0	49.7	-	-	-	-	-	-	-	-	-	-
DE35	Lückendorf	38.9	57.7	62.9	78.6	91.2	75.5	79.0	79.5	78.1	44.2	30.6	47.7
DE38	Murnauer Moos	52.6	73.2	67.2	78.7	73.3	-	-	-	-	-	-	-
DE39	Aukrug	43.0	53.6	62.1	69.0	80.7	63.2	62.6	62.0	46.3	34.1	22.3	34.8
DK31	Ulborg	50.4	65.8	63.5	80.7	82.1	74.4	68.8	70.8	64.6	49.7	44.2	53.9
DK32	Frederiksborg	37.5	47.6	49.8	64.1	72.9	64.0	58.6	58.3	49.7	37.0	27.3	38.0

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EE09	Lahemaa	47.3	65.5	88.1	79.3	80.3	78.6	67.1	56.1	52.6	50.0	49.9	50.1
EE11	Vilsandi	59.1	77.1	94.3	94.2	101.0	106.1	88.9	84.6	79.1	62.7	60.6	58.6
ES01	San Pablo	59.4	68.9	82.4	89.6	83.4	108.0	109.3	87.3	76.3	64.0	68.6	66.1
ES03	Tortosa	32.7	41.8	51.8	54.3	50.6	52.7	81.2	63.6	60.1	40.8	42.9	43.7
ES04	Logroño	42.2	64.2	69.5	75.3	67.2	80.8	78.2	72.2	61.2	32.9	42.7	33.3
ES05	Noia	89.3	86.1	91.0	86.3	80.3	75.2	98.8	74.6	89.6	85.1	81.3	83.8
ES07	Viznar	86.3	94.2	106.6	115.9	105.3	122.1	116.8	94.4	92.5	74.3	72.5	62.6
ES08	Niembro	60.9	64.6	78.5	77.7	74.6	73.7	67.6	61.7	68.1	56.3	54.2	56.8
ES09	Campisabalos	66.6	71.5	81.3	88.3	72.4	84.0	107.6	97.8	88.7	79.2	70.2	59.5
ES10	Cabo de Creus	73.5	81.3	97.6	103.4	94.1	100.3	95.6	93.7	99.3	75.6	68.4	63.6
ES11	Barcarrola	-	-	64.3	72.6	61.8	86.0	87.2	61.7	62.4	59.9	48.0	40.9
ES12	Zarra	66.6	73.7	89.5	97.5	92.5	103.3	105.5	88.8	84.9	73.2	65.5	58.1
FI09	Uto	58.9	67.7	73.5	73.1	81.1	97.2	85.6	98.3	95.1	74.0	58.5	55.6
FI17	Virolahti	44.5	60.1	83.7	85.8	86.4	90.4	81.3	77.8	59.7	46.5	45.2	45.6
FI22	Oulanka	58.9	70.2	86.6	92.2	72.2	72.8	54.1	46.2	49.3	46.5	53.3	57.2
FI37	Ahtari II	53.2	67.0	85.9	89.0	87.5	85.8	52.0	56.4	56.1	45.9	47.2	51.6
FR08A	Donon	60.6	-	-	85.6	93.5	97.7	95.3	86.5	-	-	-	-
FR08B	Donon	61.4	-	-	87.4	96.0	99.9	97.3	88.4	-	-	-	-
FR08C	Donon	61.8	-	-	88.5	97.3	100.9	98.3	89.2	-	-	-	-
FR08D	Donon	61.8	-	-	89.4	98.3	102.0	99.6	90.7	-	-	-	-
FR09	Revin	-	-	59.3	75.4	76.9	74.0	79.3	67.3	67.8	43.3	33.5	47.3
FR10	Morvan	59.5	59.0	72.7	81.3	78.0	81.2	79.3	77.7	78.7	49.8	41.2	56.4
FR12	Iraty	81.5	80.8	95.7	104.3	99.0	99.0	96.3	-	-	77.5	72.8	75.2
FR13	Peyrusse Vieille	48.8	48.7	65.6	69.8	63.5	80.6	80.7	66.6	74.8	57.1	38.5	45.8
FR14	Montandon	56.6	59.6	65.9	77.7	65.2	72.5	64.1	55.7	58.9	36.2	26.0	44.3
GB02	Eskdalemuir	57.3	64.6	67.2	66.5	72.6	60.6	50.1	59.8	44.2	39.9	45.0	46.9
GB06	Lough Navar	50.9	58.1	62.8	67.5	62.8	50.1	43.0	40.1	37.0	38.2	37.5	-
GB13	Yarner Wood	62.8	64.4	70.3	78.7	77.1	65.9	69.0	47.1	48.0	41.0	55.1	62.9
GB14	High Muffles	48.0	60.3	67.4	76.7	76.9	65.5	60.3	72.4	56.0	47.4	53.7	51.5
GB15	Strath Vaich	71.8	84.2	84.0	77.8	85.0	77.9	60.8	74.0	63.6	61.3	72.2	75.3

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB31	Aston Hill	65.2	66.7	70.9	79.6	73.9	67.2	67.7	63.8	64.5	44.9	58.3	66.0
GB32	Bottesford	48.7	50.2	53.8	58.3	61.6	51.1	56.4	54.5	52.3	39.8	38.7	40.2
GB33	Bush	60.4	67.2	73.0	68.4	68.6	61.2	49.2	53.9	47.7	47.6	51.5	52.1
GB34	Glazebury	34.4	43.7	45.5	52.5	52.8	41.9	43.1	41.1	31.1	28.4	31.7	36.0
GB36	Harwell	48.0	51.3	52.7	-	67.7	61.8	64.5	53.2	56.4	36.6	45.2	51.5
GB37	Ladybower	57.7	59.0	66.7	69.1	75.9	64.3	58.3	58.7	52.1	42.2	55.0	53.8
GB38	Lullington Heath	53.2	53.2	62.9	74.6	76.6	73.9	70.8	64.6	65.5	44.7	49.0	56.5
GB39	Sibton	47.9	48.1	52.2	62.0	68.4	59.4	58.2	56.7	48.5	36.5	42.9	42.3
GB43	Narberth	-	-	76.6	79.6	59.3	66.2	67.7	55.7	65.9	58.3	64.1	66.6
GB44	Somerton	60.3	61.6	66.9	73.8	70.0	64.6	62.1	53.5	57.4	42.9	49.6	60.5
GB45	Wicken Fen	36.1	44.0	45.4	58.3	62.2	53.8	53.9	50.1	43.5	30.1	34.4	35.7
GR01	Aliartos	46.0	61.8	64.6	70.0	83.5	79.0	64.2	69.0	54.8	38.6	38.2	41.0
GR02	Finokalia	-	96.1	111.3	116.3	114.4	121.8	129.6	126.6	108.4	92.3	86.8	78.8
HU02	K-puszta	42.5	73.7	78.3	89.3	90.4	82.7	80.0	67.2	68.5	45.0	44.4	42.0
IE31	Mace Head	78.6	86.0	92.7	91.2	85.5	71.0	59.4	59.6	66.0	60.7	74.3	76.5
IT01	Montelibretti	18.8	35.0	47.5	48.5	51.9	66.1	58.4	66.8	51.0	32.1	22.0	28.4
IT04	Ispra	19.7	44.5	47.6	63.5	61.4	77.6	78.0	51.7	44.8	21.8	22.4	18.6
LT15	Preila	42.4	63.7	70.7	74.1	78.1	-	-	65.2	58.7	47.8	40.8	47.7
LV10	Rucava	35.7	54.0	57.6	54.8	65.8	63.3	-	-	54.8	44.5	38.6	41.5
NL09	Kollumerwaard	37.0	52.0	48.8	65.0	67.1	64.7	61.8	59.9	47.8	37.5	33.0	48.3
NL10	Vredepeel	30.7	38.0	37.6	50.9	56.7	55.9	60.0	45.4	44.3	23.4	19.9	30.6
NO01	Birkenes	56.0	67.3	74.7	74.9	74.9	67.3	59.5	53.7	46.5	40.5	41.2	52.9
NO15	Tustervatn	72.5	83.7	93.2	100.1	93.0	74.7	57.9	56.1	60.8	57.8	68.4	71.2
NO39	Kaarvatn	68.3	84.6	91.3	81.6	80.5	62.0	42.3	44.7	50.5	40.7	54.8	70.5
NO41	Osen	51.2	63.6	73.2	79.2	78.0	63.7	52.1	45.1	45.4	39.8	44.8	54.1
NO42	Spitsbergen, Zepp.	77.3	78.4	93.0	77.7	86.7	63.0	47.3	47.3	59.9	69.9	71.4	68.9
NO43	Prestebakke	44.3	55.9	63.3	68.1	74.2	66.0	60.3	52.3	54.9	42.7	41.2	52.5
NO45	Jeloya	44.3	53.5	64.9	67.3	78.3	72.1	67.6	63.9	54.9	45.7	42.0	51.6
NO48	Voss	66.1	74.3	83.0	84.2	83.7	67.9	51.8	59.9	54.3	44.5	53.3	63.2

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NO52	Karmoy	62.9	70.0	74.9	82.2	80.8	75.0	62.6	67.0	69.7	56.4	60.8	63.6
NO55	Karasjok	62.4	71.7	85.3	89.8	76.5	66.3	52.4	45.9	52.9	52.8	57.1	63.9
NO56	Hurdal	43.3	51.9	59.3	63.9	72.8	59.0	56.5	51.2	44.0	36.9	38.3	50.2
PL02	Jarczew	27.8	54.0	65.0	66.3	68.0	61.1	62.3	61.4	57.5	42.3	33.7	40.2
PL03	Sniezka	59.4	66.8	82.7	96.5	109.6	101.5	94.6	99.4	98.1	66.3	63.8	56.1
PL04	Leba	53.1	72.5	75.8	82.1	89.5	83.0	75.9	70.3	63.9	52.2	41.2	53.4
PL05	Diabla Gora	51.4	70.9	81.3	85.4	84.4	71.8	68.7	60.2	58.8	50.5	39.0	48.4
PT04	Monte Velho	50.8	60.6	-	-	-	80.8	70.2	50.0	59.8	54.7	57.8	72.3
RU16	Shepeljovo	61.7	63.8	70.2	70.9	61.4	68.0	64.2	67.5	58.9	43.7	21.3	23.3
RU17	Danki	-	-	-	-	-	-	63.4	46.1	34.3	-	42.6	46.6
SE02	Rorvik	45.8	59.3	63.9	73.7	76.6	80.3	65.6	61.7	62.0	52.5	40.8	52.0
SE11	Vavihill	42.7	57.4	64.2	78.2	76.8	69.7	64.6	66.4	62.7	44.2	35.0	44.3
SE12	Aspvreten	50.4	60.5	73.1	78.1	81.5	80.9	70.9	62.7	64.5	48.3	45.6	-
SE13	Esrange	61.6	76.2	88.8	93.6	85.8	71.4	58.9	51.3	58.1	54.6	55.5	64.0
SE32	Norra Kvill	50.9	65.2	75.2	81.6	86.5	86.8	70.5	68.6	65.9	43.9	42.7	52.3
SE35	Vindeln	47.5	65.8	72.4	80.7	75.1	64.4	51.2	42.9	39.9	40.1	48.0	55.2
SI08	Iskrba	46.2	67.2	79.7	81.0	69.2	63.1	61.0	59.4	51.4	40.8	36.3	51.9
SI31	Zavodnje	36.9	62.4	73.9	84.6	77.7	88.1	82.3	74.3	76.5	48.6	35.7	38.4
SI32	Krvavec	84.5	90.8	102.4	113.5	108.9	113.5	113.1	105.2	109.3	86.0	80.5	78.3
SI33	Kovk	40.1	69.2	-	96.8	83.8	95.6	93.8	88.7	80.6	53.8	33.8	39.4
SK02	Chopok	75.6	68.5	-	108.7	114.1	112.7	95.8	71.5	84.1	-	-	67.0
SK04	Stara-Lesna	41.7	62.1	86.7	97.7	94.9	73.7	65.3	61.2	74.7	45.5	36.8	49.4
SK06	Starina	46.9	65.2	78.2	78.9	75.7	61.8	63.0	56.1	56.9	39.7	41.9	43.3

Table 3.2: Monthly data capture 1999 (µg/m³).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT02	Illmitz	95.7	95.5	95.3	95.7	95.8	96.0	96.1	95.3	94.9	96.0	95.7	95.6
AT04	Koloman	95.4	95.8	95.7	87.1	88.0	95.3	95.2	95.0	94.2	95.3	94.9	86.2
AT05	Vorhegg	95.4	96.0	94.9	95.3	94.8	94.9	94.8	94.1	95.7	95.2	95.0	94.9
BE01	Offagne	95.7	85.9	82.4	67.6	95.0	95.3	96.4	95.8	96.7	95.6	96.9	83.7
BE32	Eupen	97.0	82.7	92.2	82.4	97.0	96.2	97.2	98.5	93.3	92.2	97.5	79.6
BE35	Vezin	97.0	96.7	80.2	91.8	96.8	96.8	97.3	96.9	97.2	97.3	96.8	84.0
CH02	Payerne	99.7	99.7	99.6	99.4	99.7	99.2	99.5	99.5	99.6	99.9	99.7	98.7
CH03	Taenikon	99.7	99.9	99.6	99.3	99.7	99.9	99.5	99.7	99.7	99.5	99.7	99.6
CH04	Chaumont	96.2	98.2	98.0	99.2	84.0	99.4	99.6	88.6	99.7	99.5	99.7	94.5
CH05	Rigi	99.5	99.7	99.7	90.7	99.5	99.6	99.5	99.7	99.9	99.7	99.4	90.2
CZ01	Svratouch	98.9	99.4	99.6	99.9	99.6	99.9	99.9	94.8	99.7	98.9	100.0	99.6
CZ03	Kosetice	99.7	99.6	99.7	100.0	99.7	100.0	100.0	97.4	57.6	100.0	99.9	99.5
DE01	Westerland	92.6	96.0	98.1	97.2	99.1	98.6	96.6	76.3	99.0	91.9	98.1	91.5
DE02	Waldhof	99.5	97.6	99.2	99.2	96.2	100.0	94.9	94.8	95.8	94.1	98.5	100.0
DE03	Schauinsland	94.6	95.2	95.7	95.0	96.0	94.6	88.6	95.8	95.7	63.0	94.9	90.3
DE04	Deuselbach	91.4	90.0	49.3	57.9	86.8	89.0	91.9	92.2	91.0	0.0	0.0	0.0
DE05	Brotjacklriegel	95.4	96.0	96.9	93.2	96.5	96.8	97.3	98.0	79.0	92.1	95.1	85.6
DE07	Neuglobsow	95.2	95.1	94.9	95.1	96.0	96.0	94.9	95.8	95.8	95.3	89.0	94.6
DE08	Schmücke	95.3	95.5	94.9	95.6	96.1	95.6	96.0	96.0	95.6	95.7	96.0	95.6
DE09	Zingst	98.8	99.4	99.6	98.9	100.0	99.9	100.0	100.0	100.0	99.7	99.9	97.6
DE12	Bassum	94.4	95.4	95.6	94.4	92.9	96.0	88.6	95.7	95.7	95.8	30.3	95.6
DE17	Ansbach	95.4	94.2	95.4	80.1	95.6	96.0	95.6	85.8	95.8	49.7	95.4	88.2
DE26	Ueckermünde	94.5	84.5	94.8	95.4	95.7	93.2	95.8	95.8	95.7	95.6	95.7	95.7
DE31	Wiesenburg	92.6	96.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DE35	Lückendorf	95.4	95.5	95.0	96.0	94.0	96.1	95.4	95.6	95.4	95.6	95.7	96.0
DE38	Murnauer Moos	96.6	99.7	99.9	99.6	64.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DE39	Aukrug	95.2	94.9	93.5	95.3	95.0	88.1	95.4	95.4	93.6	95.4	95.7	96.0
DK31	Ulborg	99.2	99.3	99.3	99.0	99.3	99.2	99.1	94.8	99.0	99.2	99.6	89.7
DK32	Frederiksborg	99.7	99.7	99.9	99.7	99.7	100.0	99.7	92.3	99.7	95.7	99.7	94.9

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EE09	Lahemaa	80.1	69.3	99.3	84.2	99.6	97.5	99.2	100.0	99.4	99.2	92.6	98.1
EE11	Vilsandi	95.0	82.9	96.4	94.0	95.7	92.9	87.6	79.8	91.9	93.7	95.8	68.8
ES01	San Pablo	80.8	83.5	93.0	95.3	95.4	93.1	95.2	95.8	88.9	86.3	93.1	91.7
ES03	Tortosa	95.7	95.5	91.8	95.4	95.8	95.0	95.7	91.9	93.5	95.8	95.6	94.1
ES04	Logroño	60.9	94.3	95.7	94.0	87.8	91.9	90.7	87.2	89.6	95.0	94.2	95.0
ES05	Noia	94.2	95.8	95.4	90.3	95.8	95.7	95.3	95.7	95.8	95.6	95.7	86.4
ES07	Viznar	94.5	94.8	93.4	95.8	95.8	95.3	94.9	95.7	95.8	92.9	94.0	88.7
ES08	Niembro	95.8	95.8	92.9	95.7	95.0	95.6	95.3	93.3	90.1	95.6	93.8	93.3
ES09	Campisabalos	93.4	95.2	93.8	89.4	85.6	89.0	91.0	95.4	88.1	95.8	95.4	91.1
ES10	Cabo de Creus	95.8	95.2	91.0	95.6	95.6	95.8	95.2	89.7	95.0	92.9	91.8	94.9
ES11	Barcarrola	0.0	0.0	87.5	93.8	88.3	92.5	94.8	93.5	95.3	91.4	95.6	95.0
ES12	Zarra	95.7	95.8	95.7	95.6	95.4	91.5	95.7	95.7	92.2	95.7	95.4	94.8
FI09	Uto	82.1	98.7	99.6	100.0	97.6	100.0	98.9	100.0	100.0	96.6	100.0	100.0
FI17	Virolahti	100.0	98.7	97.0	100.0	97.8	94.9	97.8	61.3	88.9	100.0	99.4	100.0
FI22	Oulanka	99.1	100.0	100.0	99.2	100.0	100.0	97.7	99.9	100.0	93.4	88.1	99.6
FI37	Ahtari II	98.4	99.4	99.5	98.6	100.0	96.7	97.6	87.0	79.7	100.0	100.0	100.0
FR08A	Donon	67.7	0.0	18.4	97.5	99.6	97.8	86.4	99.5	0.1	0.0	0.0	0.0
FR08B	Donon	67.7	0.0	18.4	97.1	99.7	98.2	86.8	99.7	0.1	0.0	0.0	0.0
FR08C	Donon	67.9	0.0	18.3	97.4	99.7	98.2	86.7	99.9	0.1	0.0	0.0	0.0
FR08D	Donon	67.9	0.0	18.4	97.6	99.7	98.1	86.4	99.6	0.1	0.0	0.0	0.0
FR09	Revin	12.0	19.9	70.3	58.2	99.9	99.6	95.4	96.0	99.6	99.5	99.4	99.6
FR10	Morvan	57.7	95.7	76.9	95.1	95.2	92.8	92.9	67.3	89.6	66.1	93.9	81.3
FR12	Iraty	92.9	86.3	89.5	85.8	68.8	85.8	95.2	30.2	0.0	82.1	98.9	97.3
FR13	Peyrusse Vieille	99.3	99.9	99.7	94.7	88.7	99.4	99.2	100.0	99.0	98.9	99.3	97.7
FR14	Montandon	99.3	97.6	93.1	90.4	95.7	96.9	98.1	93.3	99.3	98.5	95.6	93.0
GB02	Eskdalemuir	92.2	97.6	99.9	73.8	85.5	99.9	99.7	98.9	99.9	99.9	98.9	99.7
GB06	Lough Navar	99.1	98.7	100.0	99.9	97.4	99.9	99.3	99.9	94.9	98.7	64.7	0.0
GB13	Yarner Wood	98.1	96.6	99.9	98.8	90.2	99.7	99.6	99.3	99.9	98.3	100.0	99.9
GB14	High Muffles	97.8	99.9	99.9	98.9	99.9	99.9	99.5	99.9	99.9	99.9	95.7	98.9

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB15	Strath Vaich	96.9	100.0	99.5	84.4	78.8	99.7	99.6	99.7	99.9	96.5	74.9	99.6
GB31	Aston Hill	99.7	99.6	99.9	99.9	98.8	96.0	98.4	98.7	99.9	98.7	99.9	99.9
GB32	Bottesford	99.1	99.7	99.7	96.1	95.4	94.6	95.6	99.2	83.8	87.6	96.4	98.7
GB33	Bush	99.5	99.9	100.0	97.1	99.7	99.4	99.7	80.6	87.8	99.1	99.6	100.0
GB34	Glazebury	99.5	97.6	92.1	77.6	98.9	78.2	99.5	99.9	99.9	96.5	95.7	96.9
GB36	Harwell	98.8	99.0	99.7	11.5	96.4	93.8	99.1	99.6	98.8	96.2	100.0	99.7
GB37	Ladybower	99.2	97.6	99.9	91.4	98.8	99.2	94.1	97.6	99.4	99.5	92.9	99.9
GB38	Lullington Heath	93.8	97.2	99.9	99.6	94.8	98.2	99.2	99.5	98.5	99.5	96.1	86.8
GB39	Sibton	99.1	99.9	99.3	95.1	99.7	99.3	98.4	94.2	60.7	96.6	99.7	99.2
GB43	Narberth	44.2	0.0	91.3	97.1	98.1	99.2	98.8	94.8	97.8	89.7	98.1	88.8
GB44	Somerton	99.1	99.3	95.7	99.0	99.7	99.7	99.3	99.7	95.7	99.2	99.7	99.5
GB45	Wicken Fen	70.2	92.3	99.3	96.2	99.3	98.8	97.4	96.2	99.4	99.5	96.4	99.7
GR01	Aliartos	63.0	100.0	54.4	87.6	88.6	76.1	84.5	60.2	82.2	84.9	100.0	100.0
GR02	Finokalia	0.0	64.0	69.1	78.1	88.2	93.6	68.8	73.1	97.6	85.1	67.9	90.9
HU02	K-puszta	98.1	96.4	97.6	99.9	94.8	89.3	96.9	96.1	91.0	95.6	88.6	64.8
IE31	Mace Head	99.2	99.7	100.0	100.0	98.5	100.0	99.9	100.0	100.0	99.9	99.4	99.9
IT01	Montelibretti	82.0	96.4	100.0	100.0	96.8	100.0	100.0	98.3	98.8	100.0	100.0	100.0
IT04	Ispra	100.0	100.0	96.1	97.4	99.6	99.0	95.6	99.6	99.9	95.6	95.8	99.3
LT15	Preila	100.0	100.0	100.0	98.6	78.8	31.7	42.6	100.0	85.4	82.5	89.0	69.5
LV10	Rucava	95.3	99.9	99.9	89.2	96.5	98.3	23.0	0.0	87.5	98.7	95.3	89.2
NL09	Kollumerwaard	100.0	100.0	98.8	100.0	100.0	100.0	100.0	100.0	99.2	99.9	98.5	99.7
NL10	Vredepeel	100.0	89.9	98.9	99.0	93.0	88.9	97.4	100.0	86.5	95.6	98.5	83.7
NO01	Birkenes	99.9	99.7	100.0	100.0	99.7	98.8	100.0	99.7	99.6	99.9	100.0	99.2
NO15	Tustervatn	99.9	100.0	100.0	100.0	100.0	100.0	99.3	100.0	100.0	100.0	99.7	100.0
NO39	Kaarvatn	99.7	100.0	100.0	100.0	100.0	99.6	100.0	100.0	100.0	100.0	100.0	100.0
NO41	Osen	99.7	100.0	100.0	100.0	99.7	100.0	100.0	100.0	99.7	100.0	99.4	99.2
NO42	Spitsbergen, Zepp.	100.0	100.0	99.7	99.9	100.0	97.1	100.0	98.3	94.9	100.0	100.0	100.0
NO43	Prestebakke	99.3	100.0	99.7	99.7	99.6	98.3	99.3	99.9	99.9	100.0	98.5	98.1

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NO45	Jeloya	100.0	99.7	99.3	99.6	100.0	97.9	99.6	100.0	100.0	99.2	100.0	100.0
NO48	Voss	100.0	99.0	100.0	100.0	100.0	99.7	100.0	100.0	98.8	100.0	100.0	99.5
NO52	Karmoy	99.9	99.7	100.0	100.0	100.0	99.2	100.0	100.0	98.8	100.0	100.0	100.0
NO55	Karasjok	100.0	99.9	100.0	93.5	96.4	100.0	99.2	73.8	100.0	99.5	100.0	100.0
NO56	Hurdal	98.7	100.0	100.0	99.7	100.0	100.0	100.0	99.1	99.7	100.0	99.7	99.7
PL02	Jarczew	99.9	99.9	100.0	89.0	99.2	98.2	99.2	98.3	96.5	95.6	99.3	99.5
PL03	Sniezka	91.8	88.5	100.0	100.0	100.0	100.0	97.8	99.6	100.0	100.0	100.0	100.1
PL04	Leba	99.9	100.0	100.0	99.4	100.0	100.0	100.0	93.8	99.9	100.0	98.1	93.8
PL05	Diabla Gora	100.0	100.0	99.1	99.4	100.0	96.5	99.3	96.5	99.7	98.8	100.0	92.5
PT04	Monte Velho	87.0	99.9	23.7	0.0	24.5	99.7	93.4	99.2	93.3	98.8	100.0	97.3
RU16	Shepeljovo	100.0	97.3	97.8	95.0	98.4	97.8	98.5	96.5	99.9	100.0	100.0	100.0
RU17	Danki	0.0	0.0	0.0	0.0	0.0	0.0	63.6	88.4	61.0	45.2	100.0	100.0
SE02	Rorvik	99.2	99.1	99.6	98.8	98.9	99.9	100.0	99.1	99.6	100.0	100.0	80.4
SE11	Vavihill	99.3	100.0	100.0	100.0	99.1	100.0	100.0	100.0	99.2	100.0	99.3	81.6
SE12	Aspvreten	100.0	99.0	99.6	90.4	99.9	99.6	100.0	100.0	93.8	78.9	95.7	46.5
SE13	Esrange	99.6	100.0	100.0	99.3	99.9	100.0	100.0	100.0	100.0	99.3	100.0	100.0
SE32	Norra Kvill	98.8	97.5	99.7	99.2	96.8	93.5	100.0	100.0	99.3	74.5	94.6	97.6
SE35	Vindeln	98.9	99.3	100.0	99.3	99.9	100.0	99.7	100.0	100.0	99.1	99.6	99.6
SI08	Iskrba	95.4	86.2	95.4	95.3	94.9	93.6	75.3	94.9	76.7	83.5	95.1	83.2
SI31	Zavodnje	92.9	64.4	89.8	78.1	83.9	92.2	89.4	91.8	89.2	92.9	91.0	90.7
SI32	Krvavec	90.7	87.2	78.0	86.9	86.7	80.4	92.3	87.2	89.2	98.7	99.2	87.5
SI33	Kovk	93.7	73.2	29.6	90.3	86.3	88.9	80.2	81.0	83.3	88.7	88.5	85.5
SK02	Chopok	59.1	64.1	30.2	72.1	100.0	87.8	62.4	96.1	72.9	0.0	0.0	99.3
SK04	Stara-Lesna	97.6	99.1	99.5	95.7	96.6	92.8	89.0	91.4	94.4	77.4	87.8	94.9
SK06	Starina	97.7	99.6	99.7	99.2	99.6	97.6	95.7	94.2	99.3	98.8	92.8	97.7

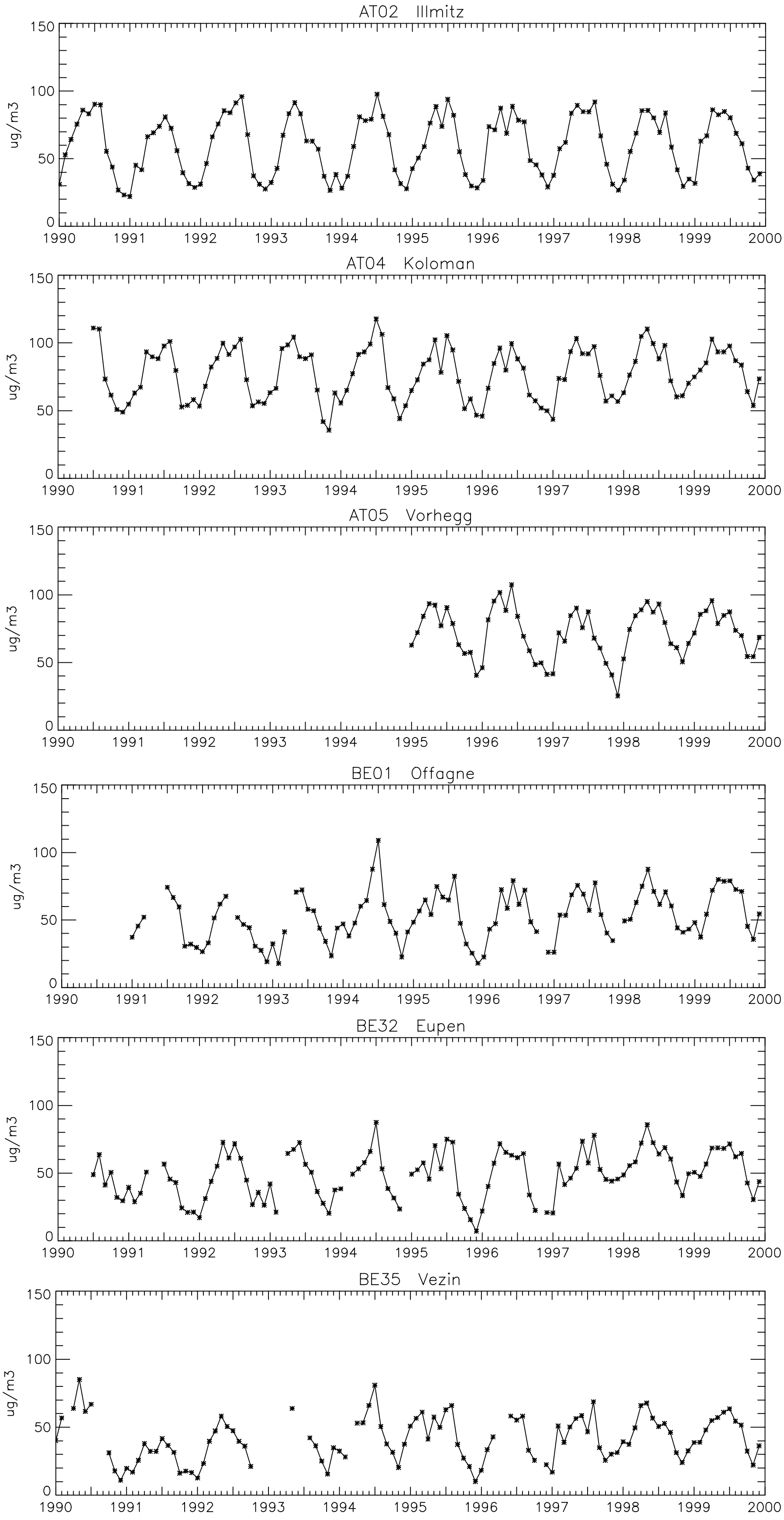


Figure 3.1: Seasonal variation, 1990–1999.

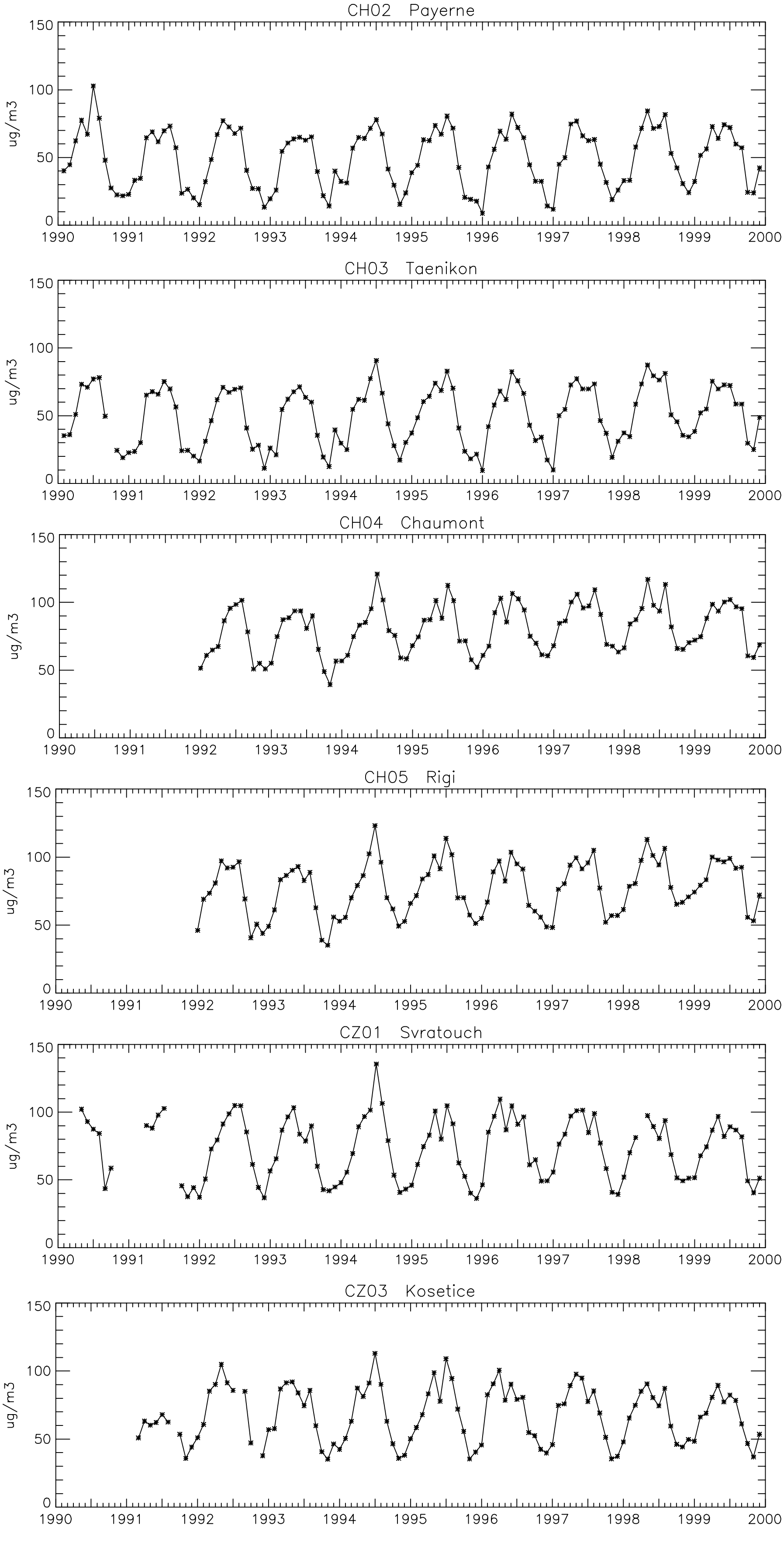
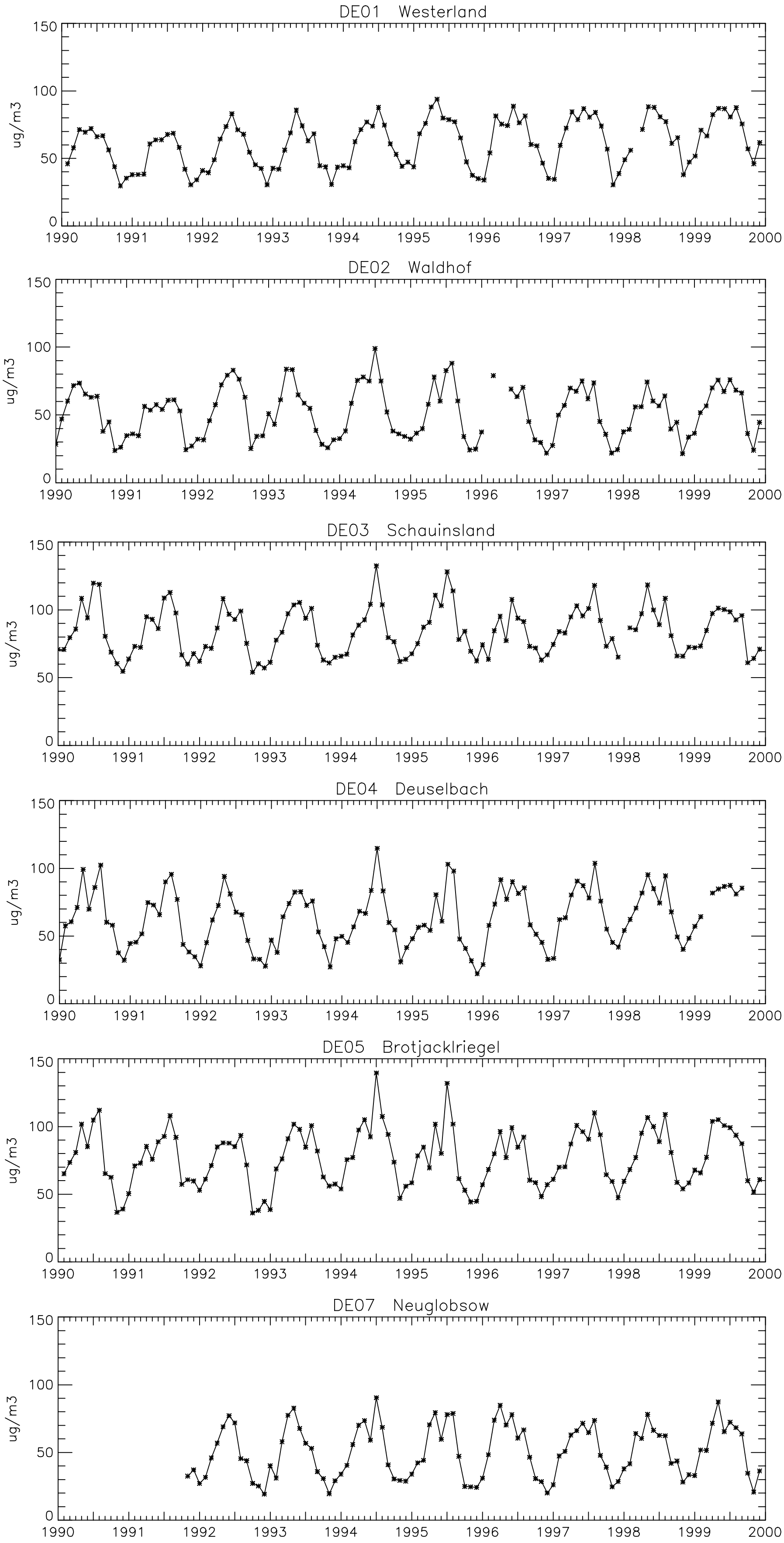


Figure 3.1, cont.



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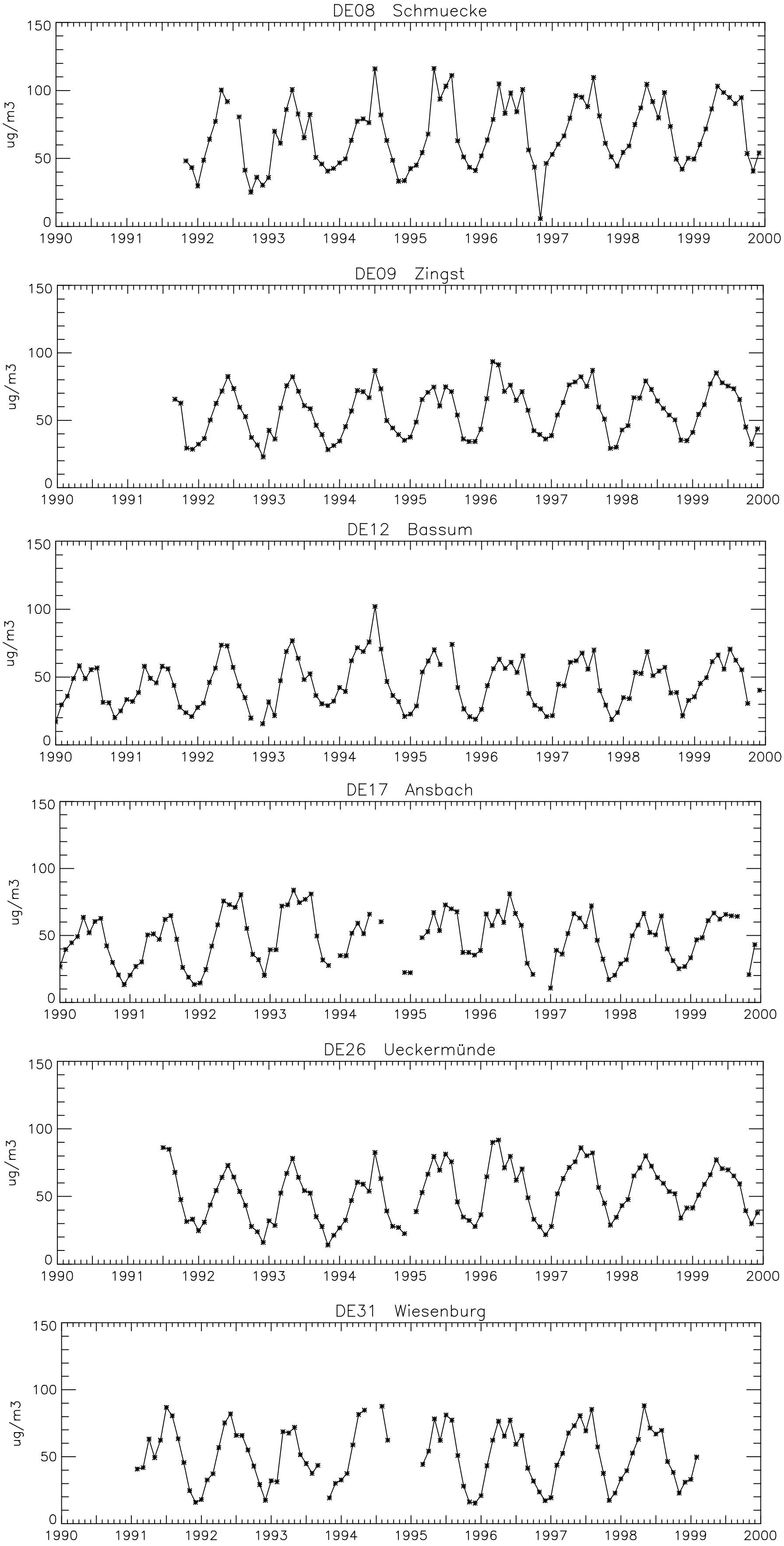

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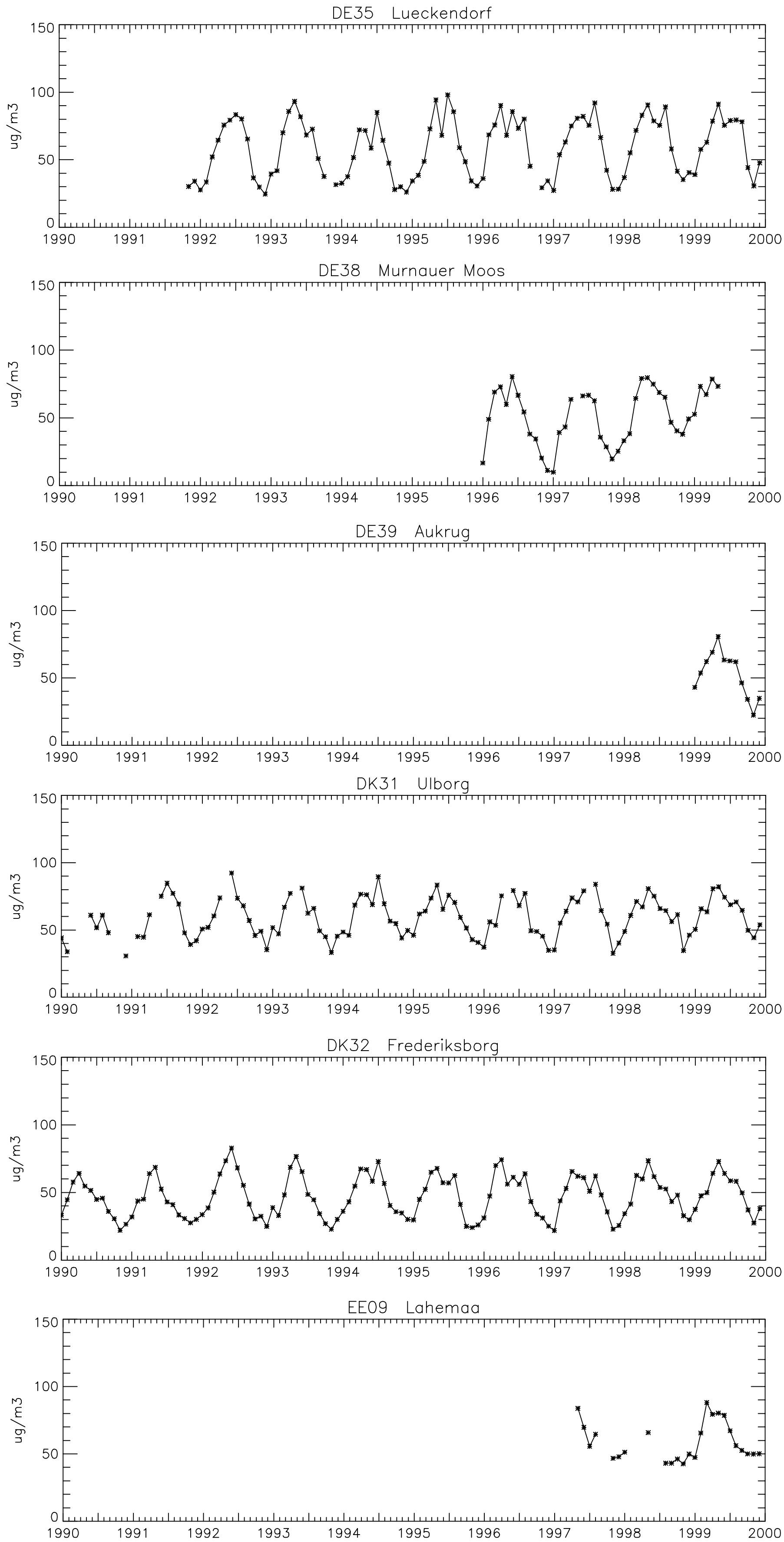

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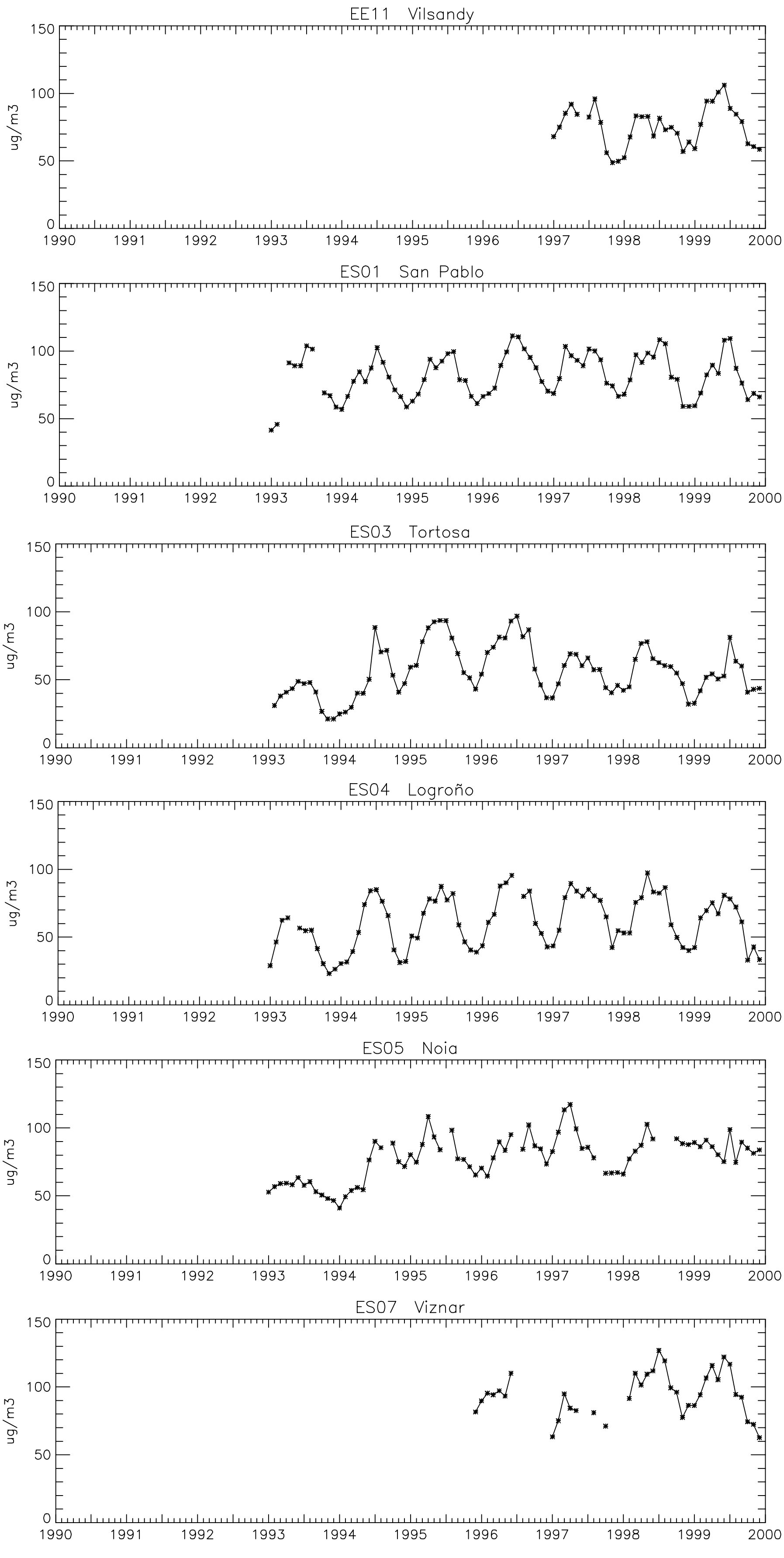

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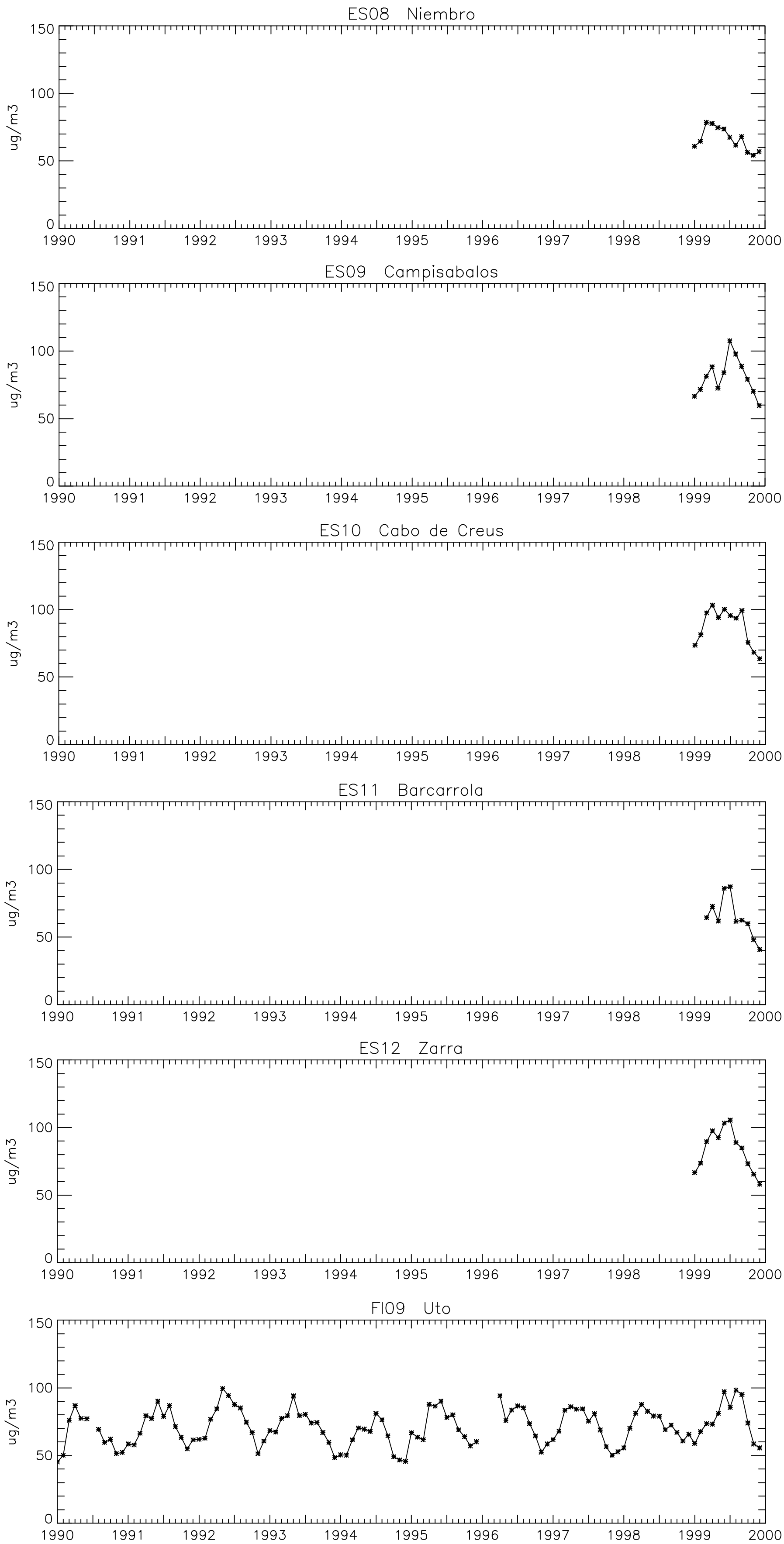

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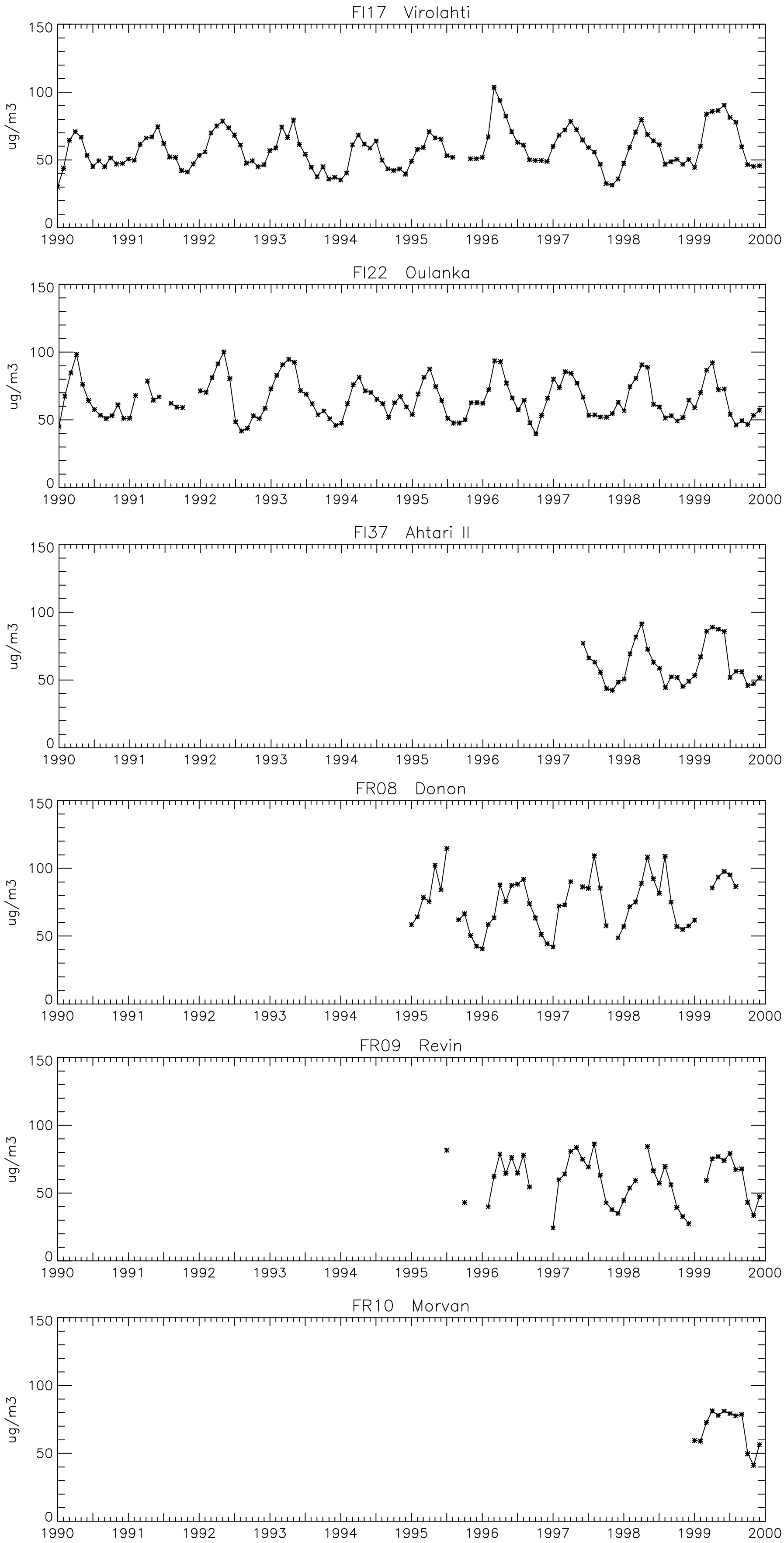
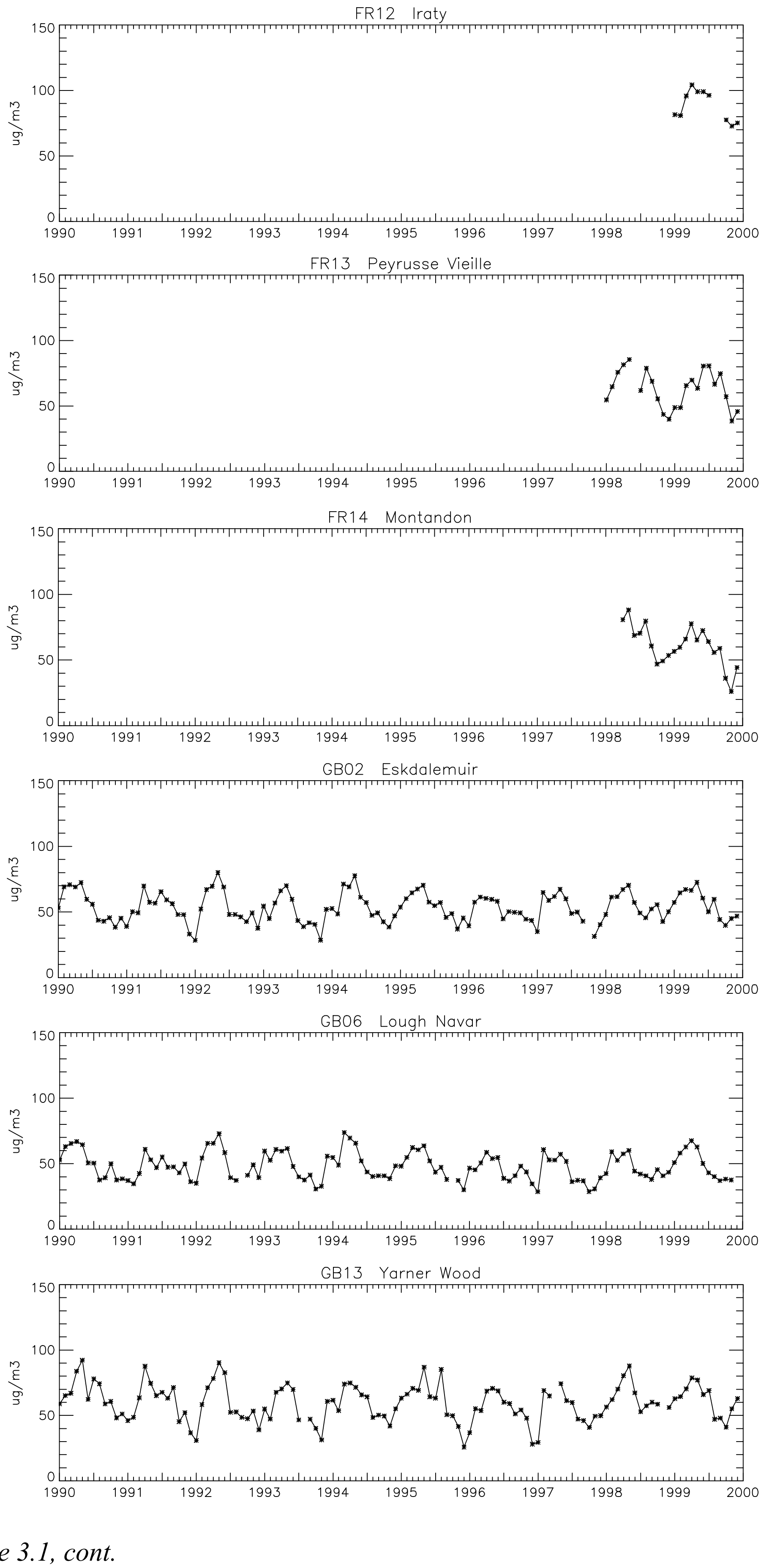


Figure 3.1, cont.



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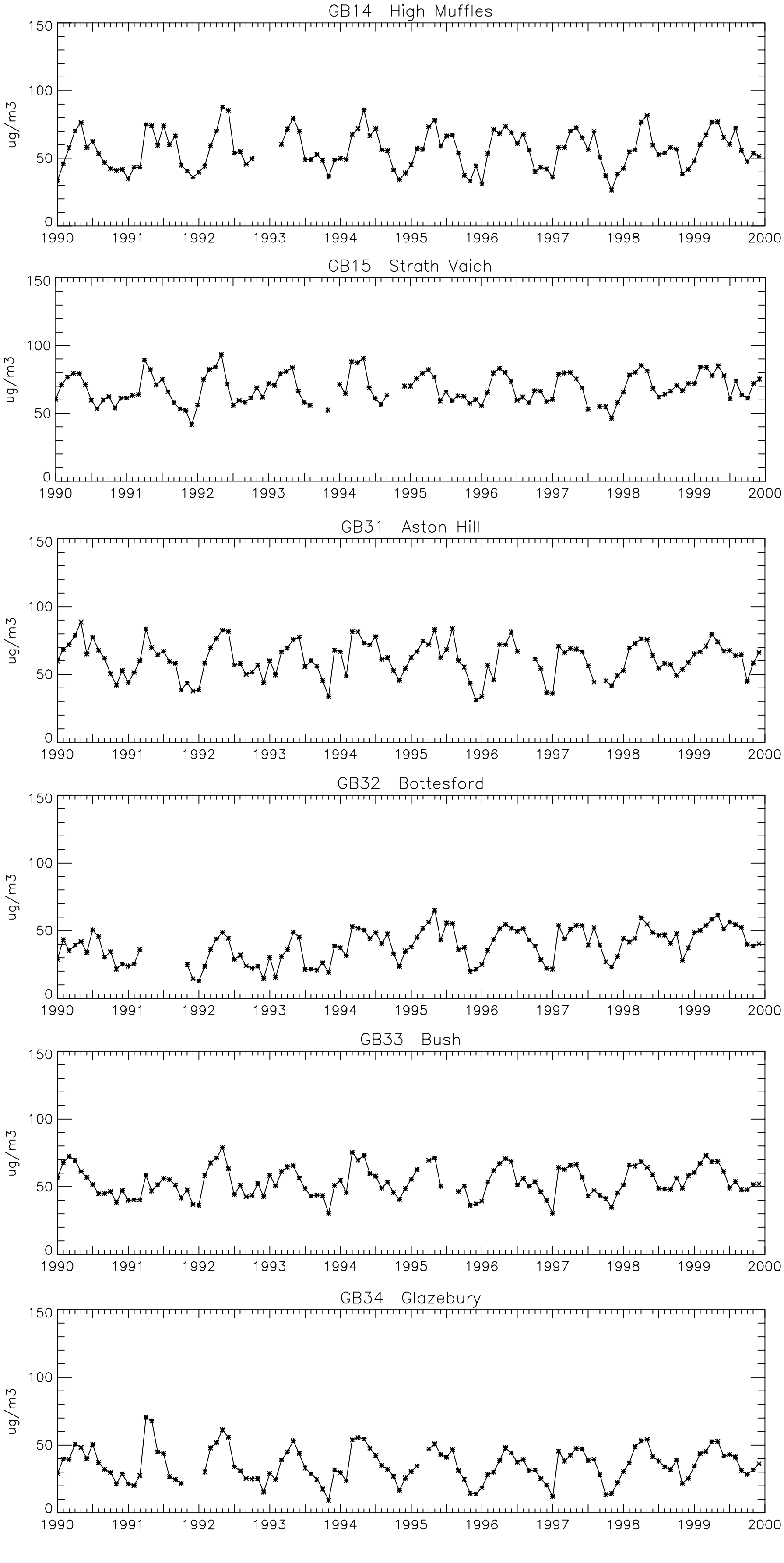

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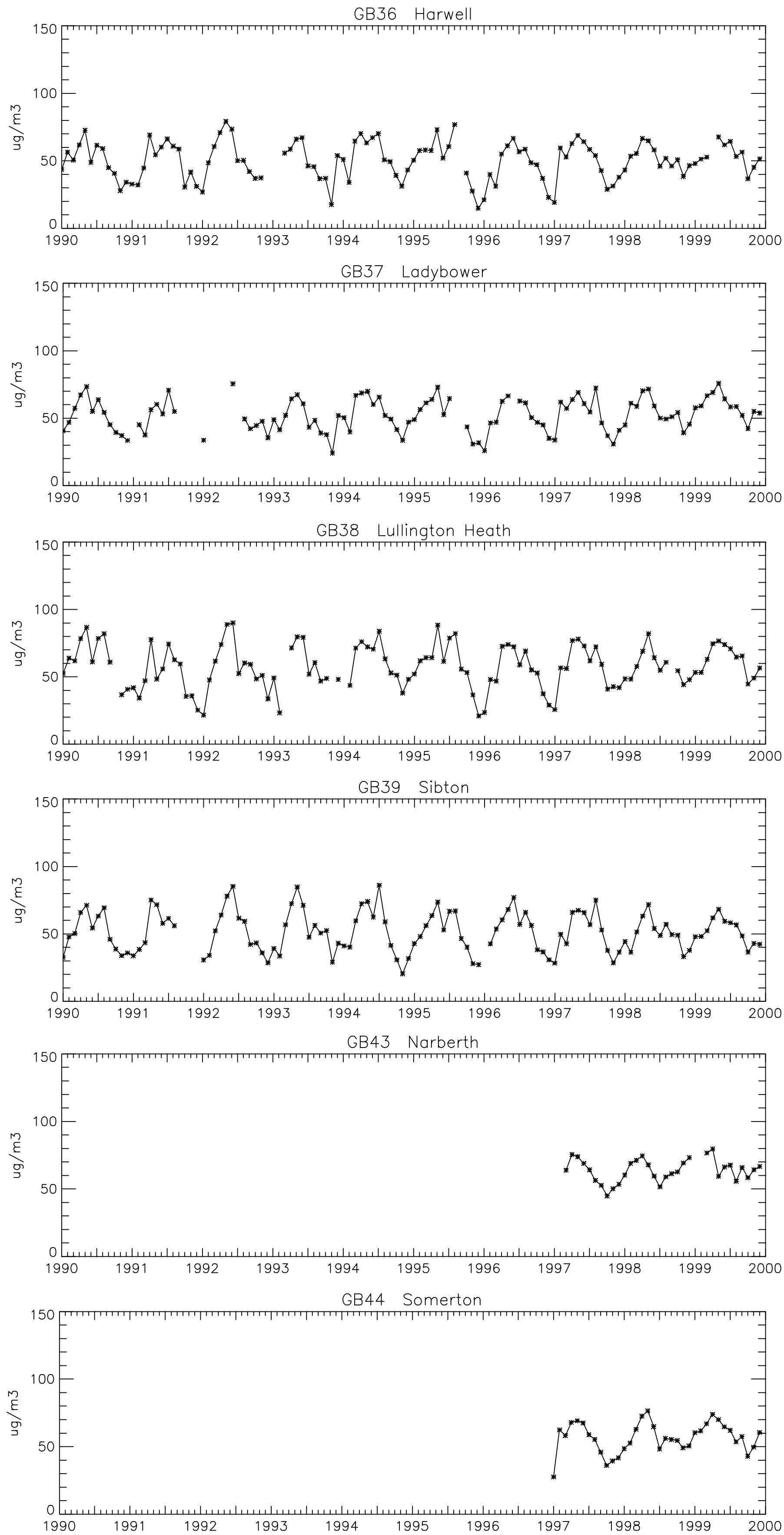

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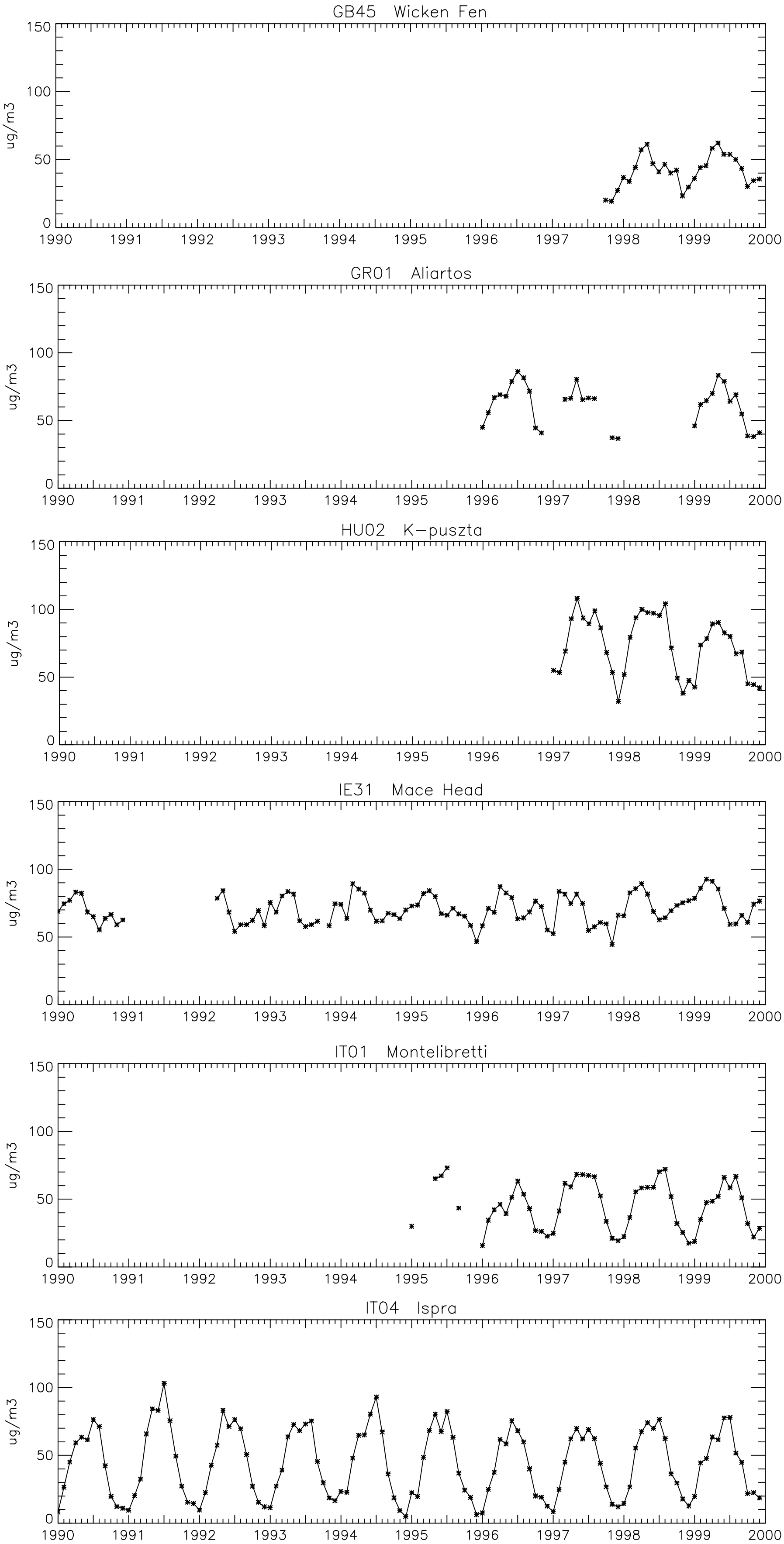

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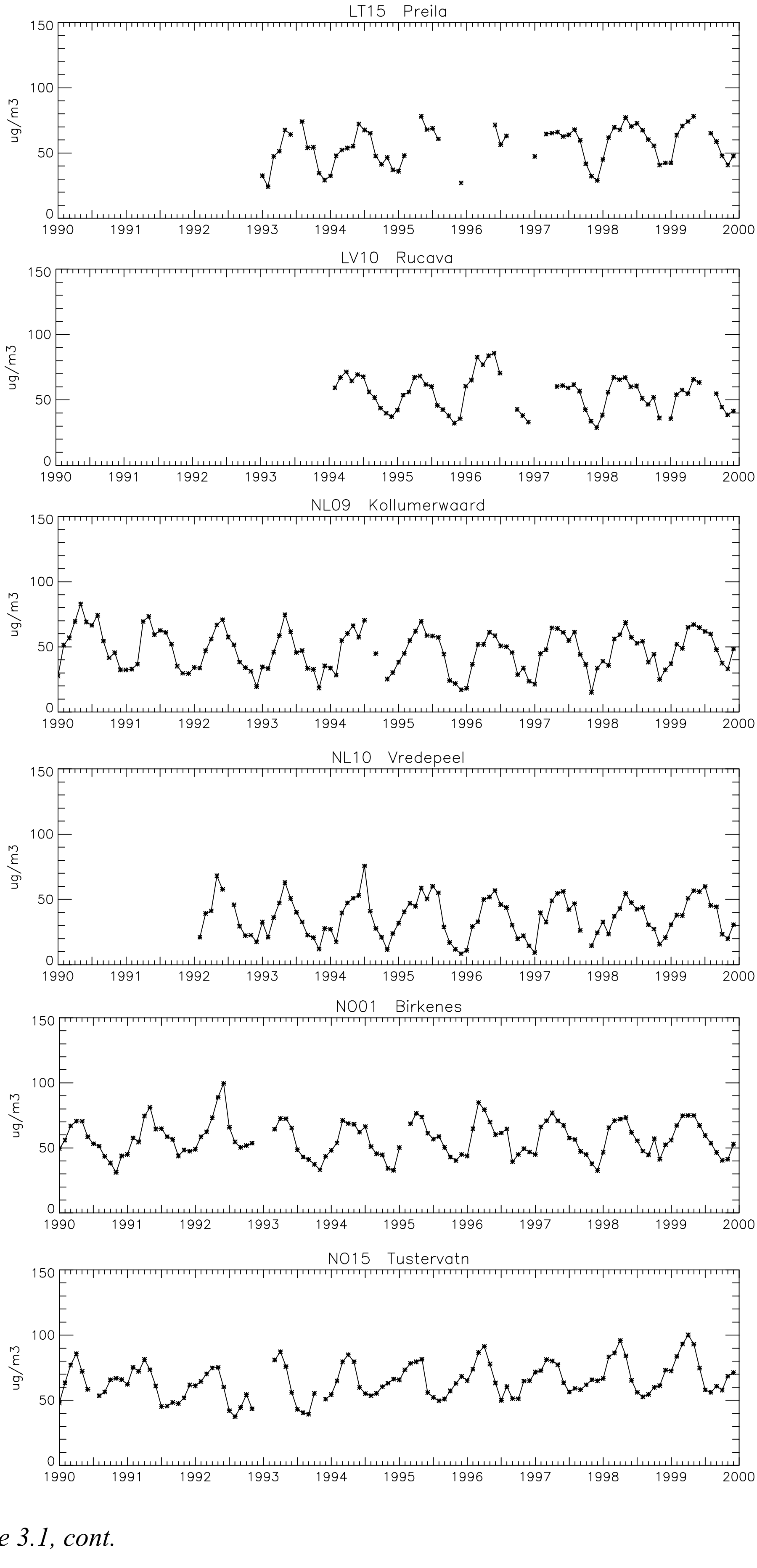

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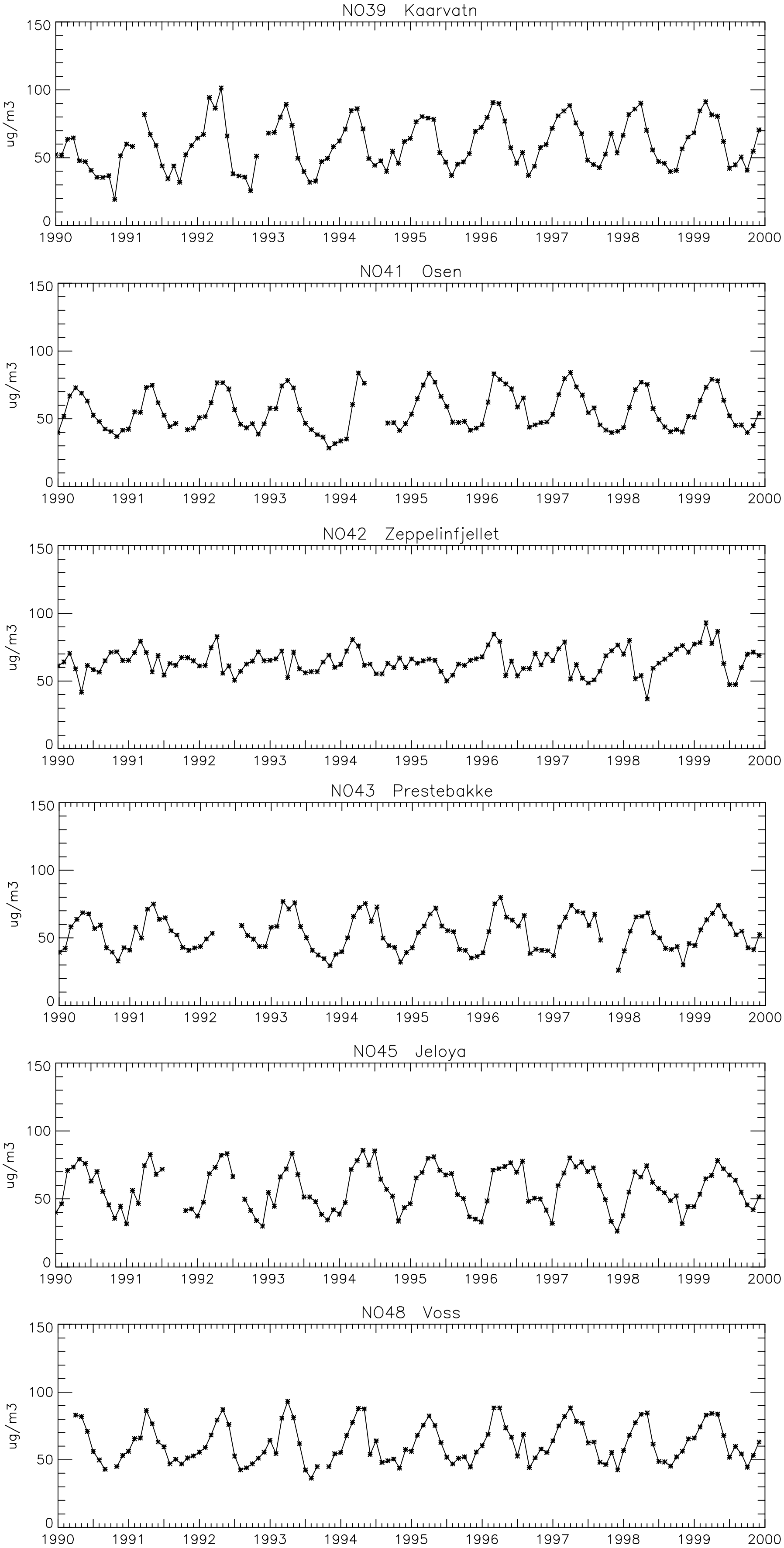

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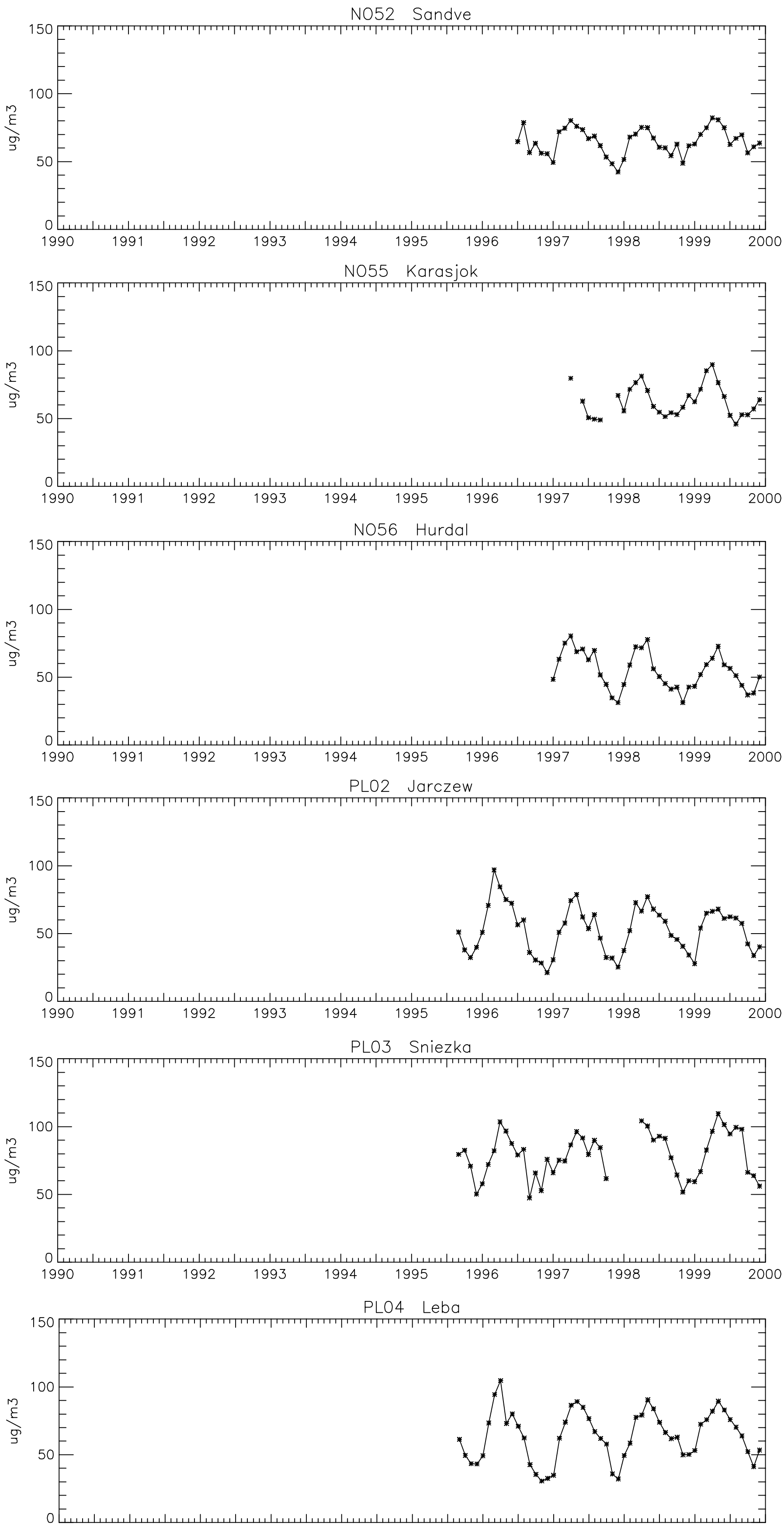

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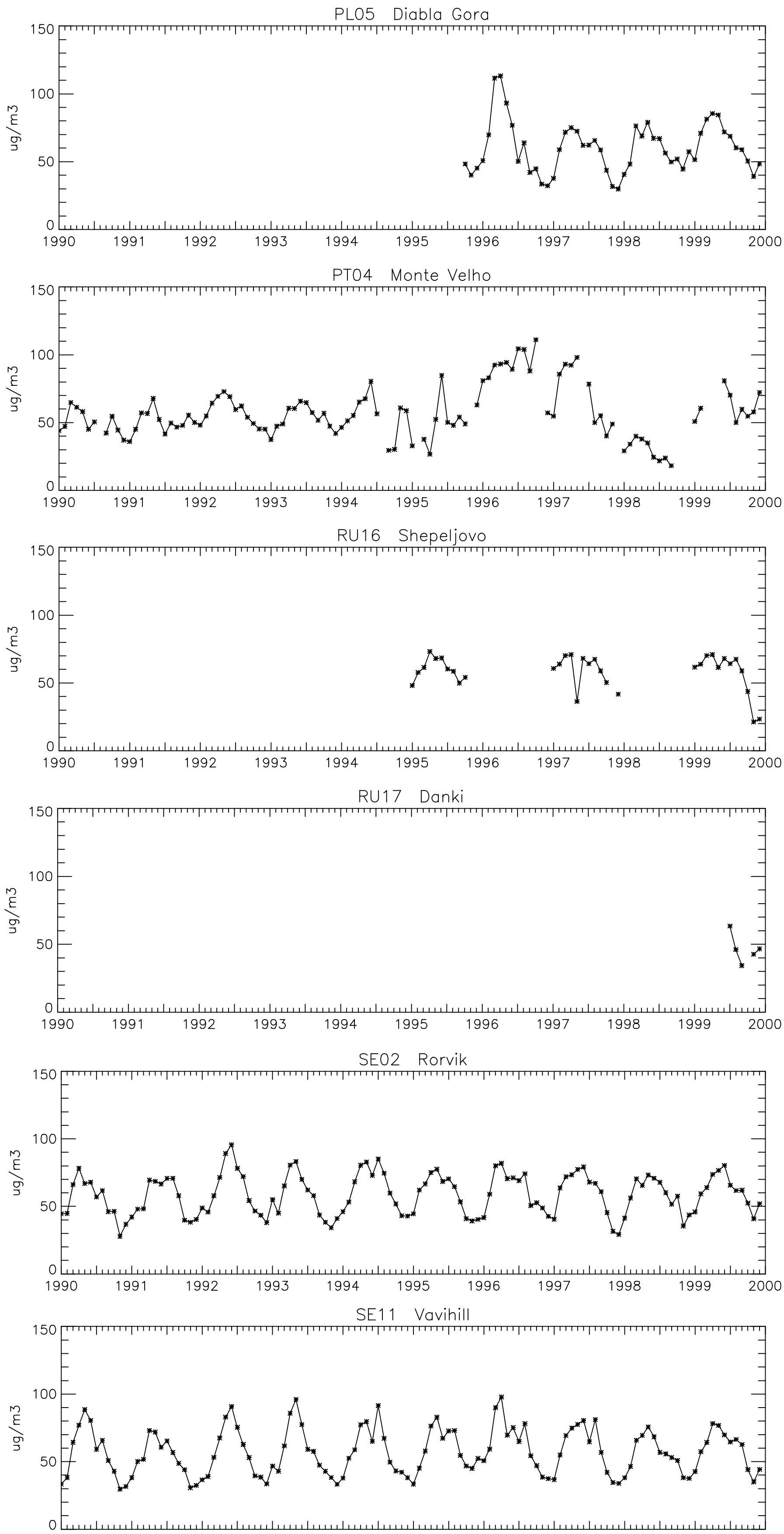

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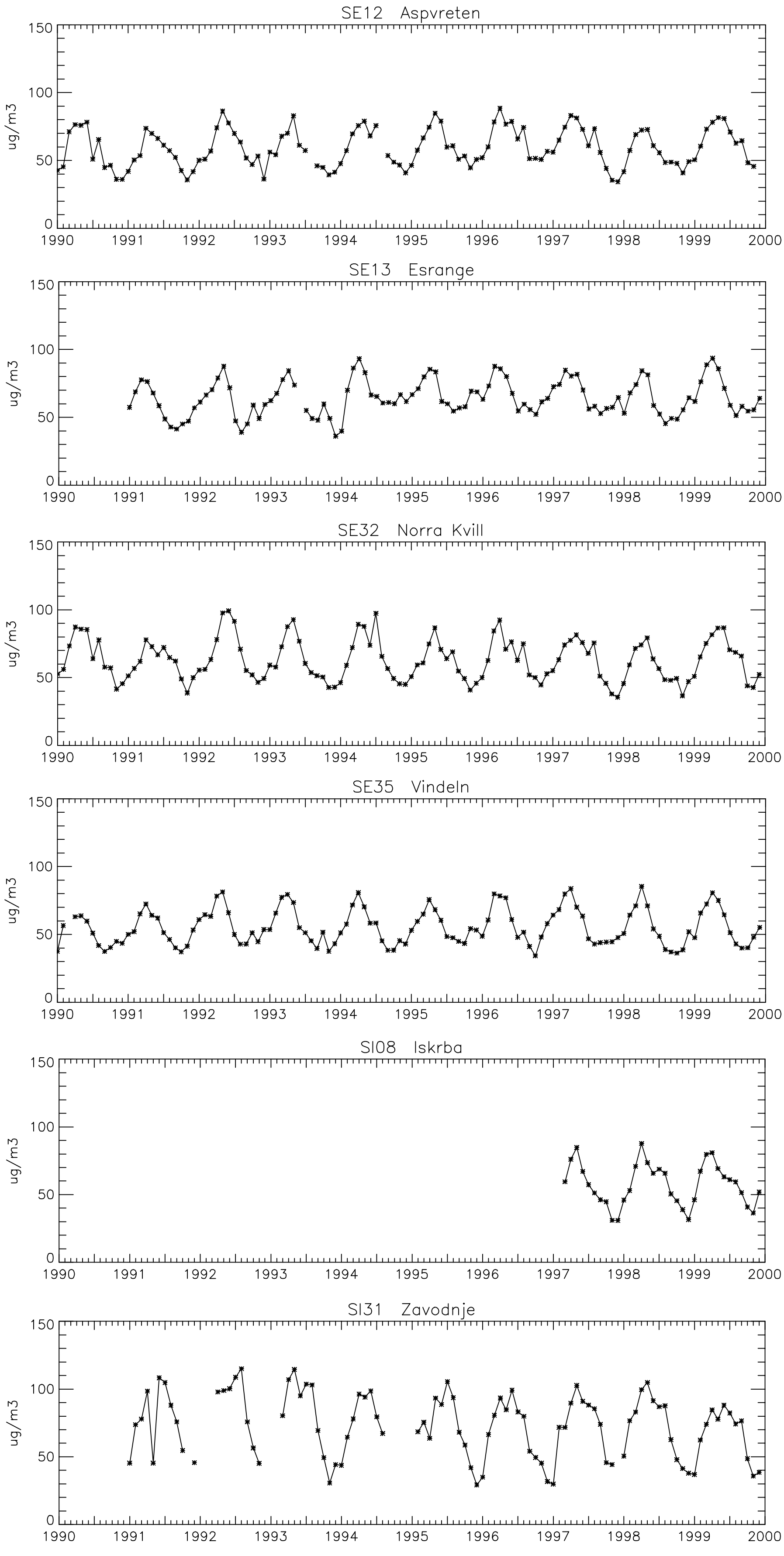

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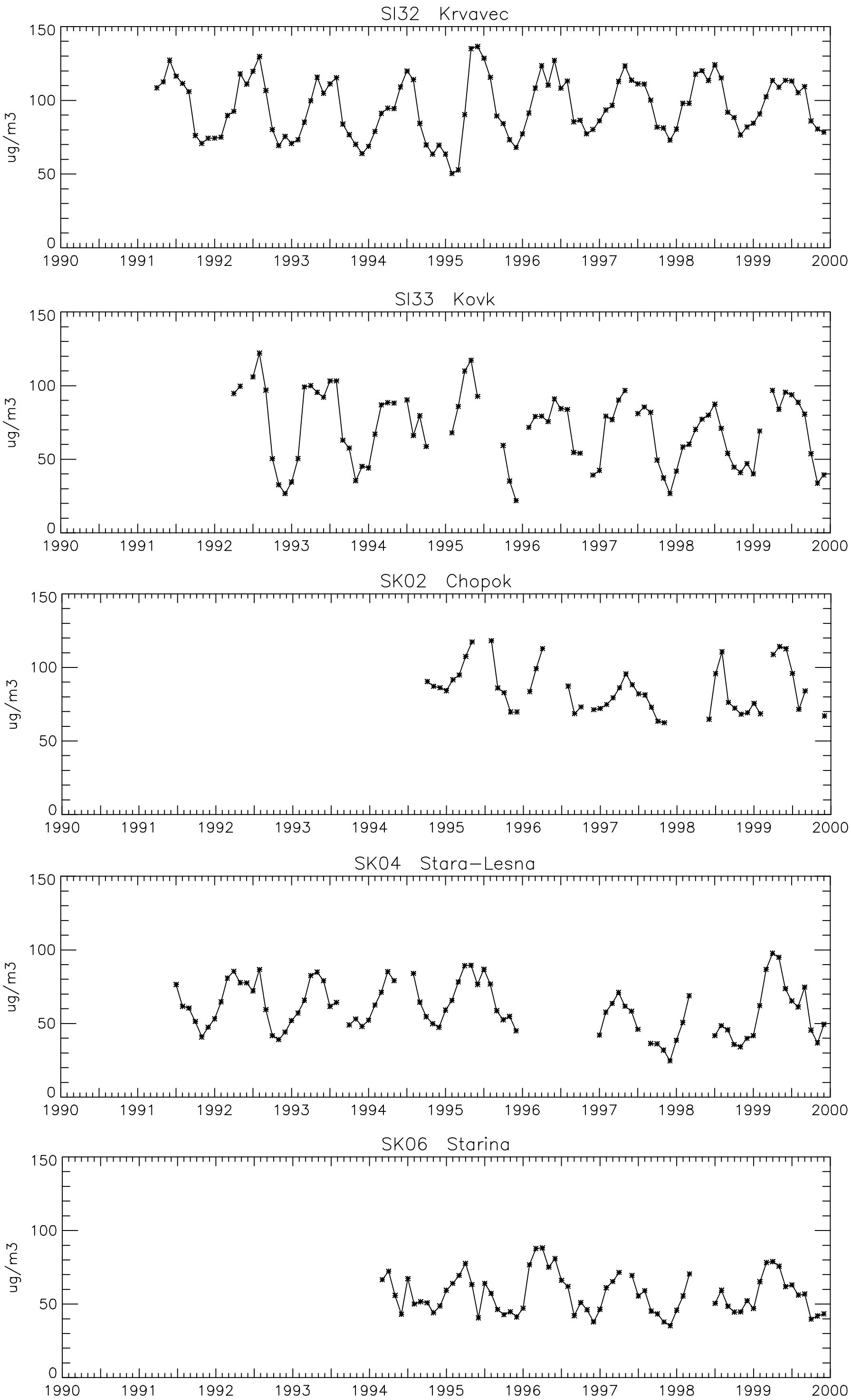


Figure 3.1, cont.

Annex 4

Diurnal variation,
April–September 1999

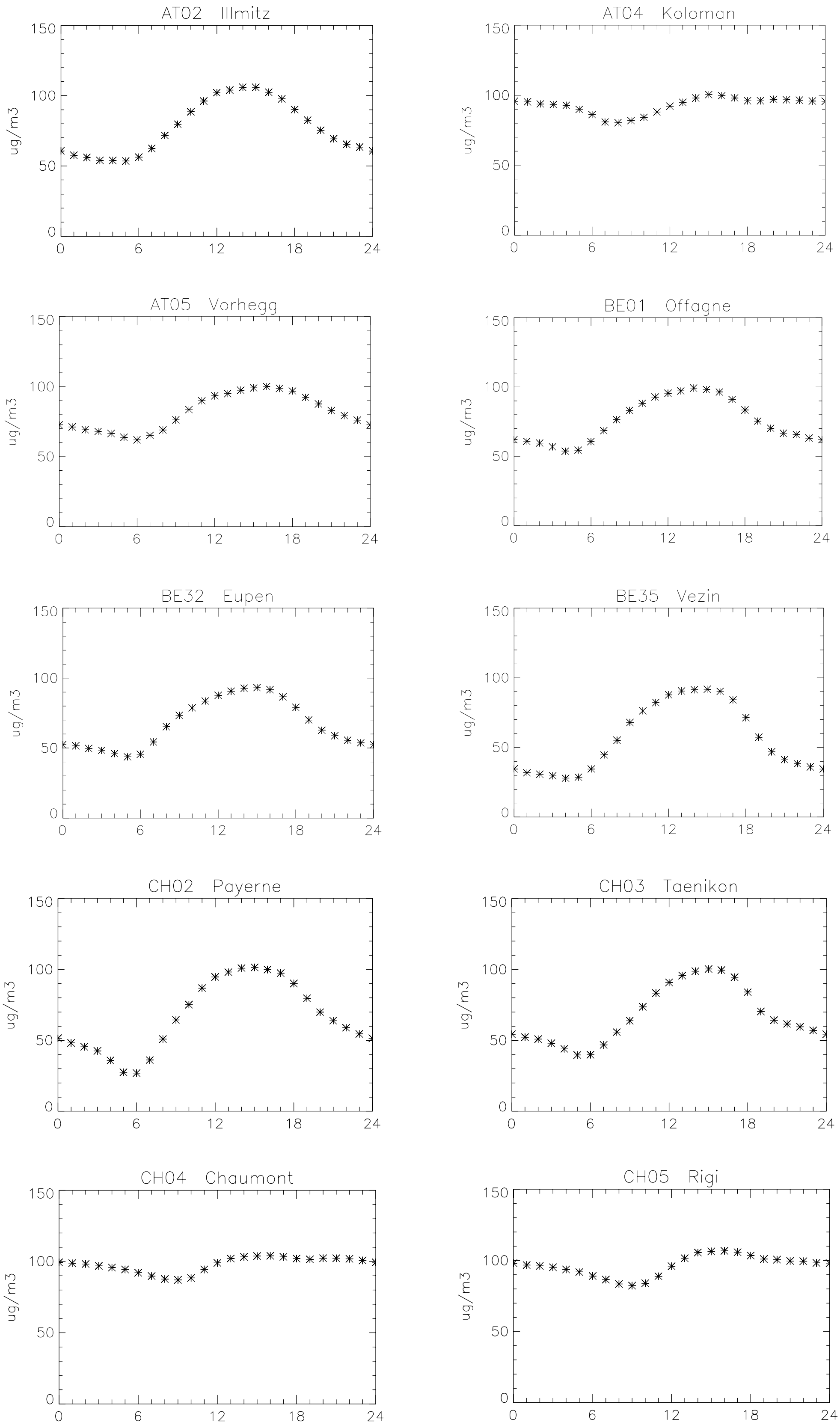


Figure 4.1: Diurnal variation, April–September 1999.

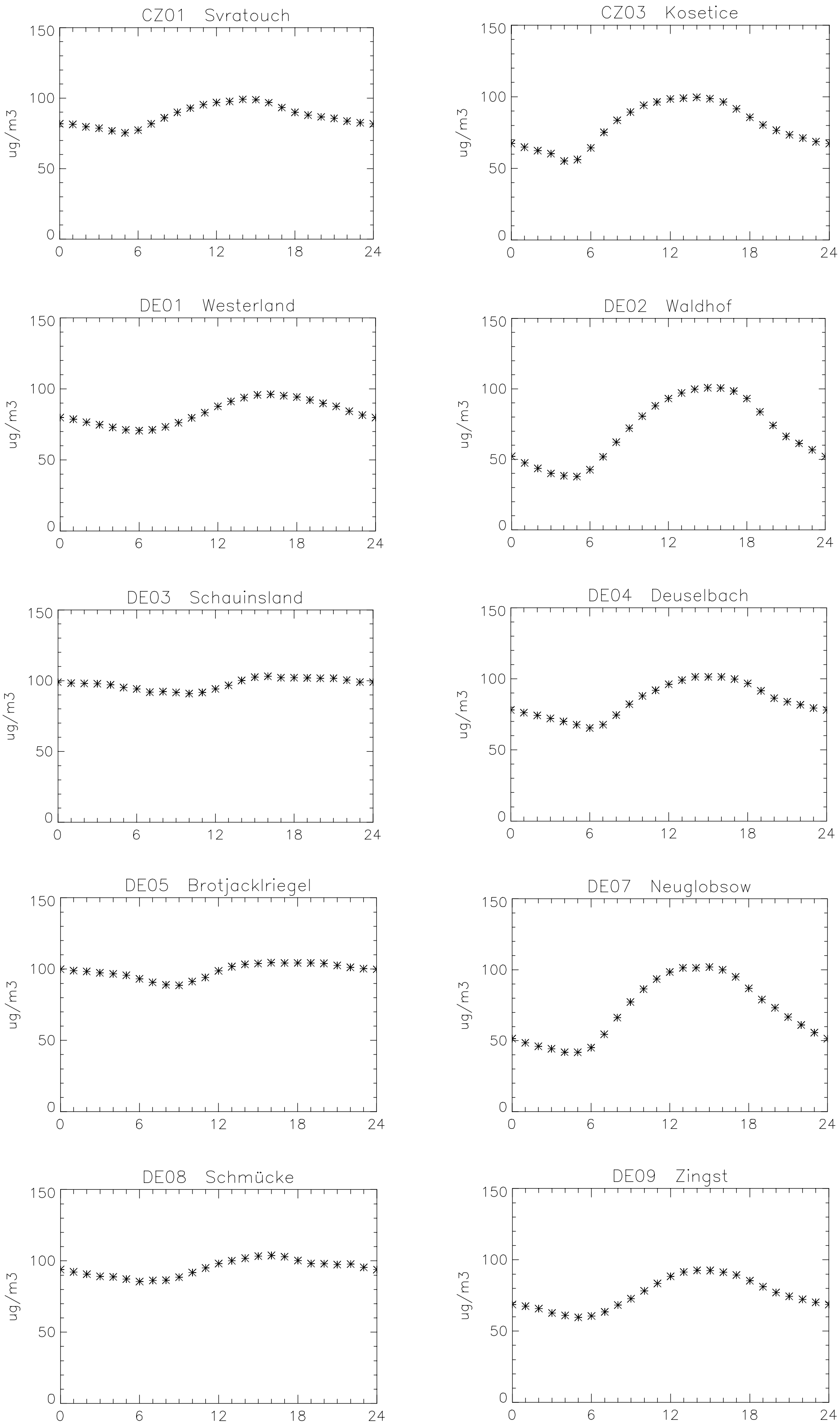


Figure 4.1, cont.

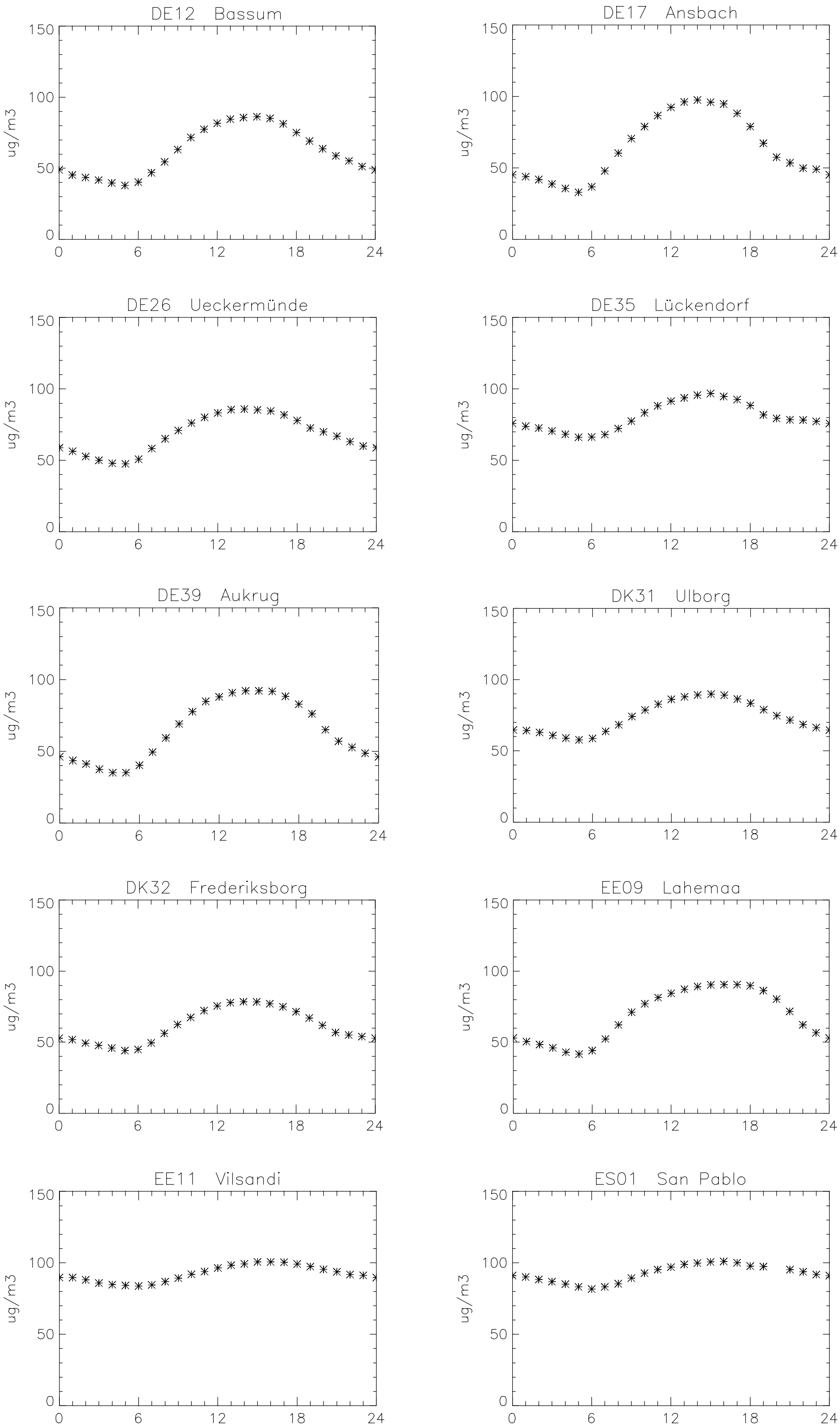
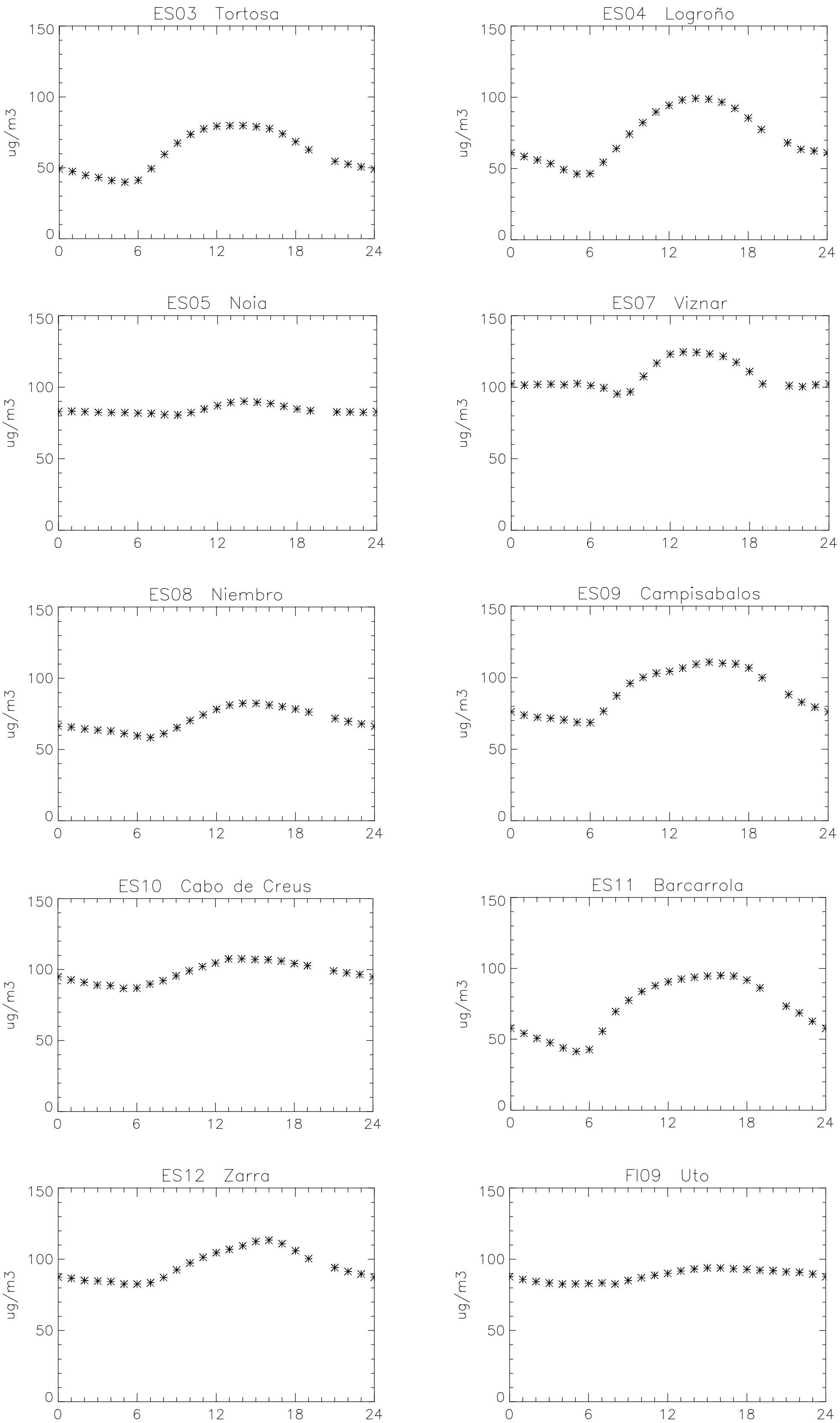


Figure 4.1, cont.



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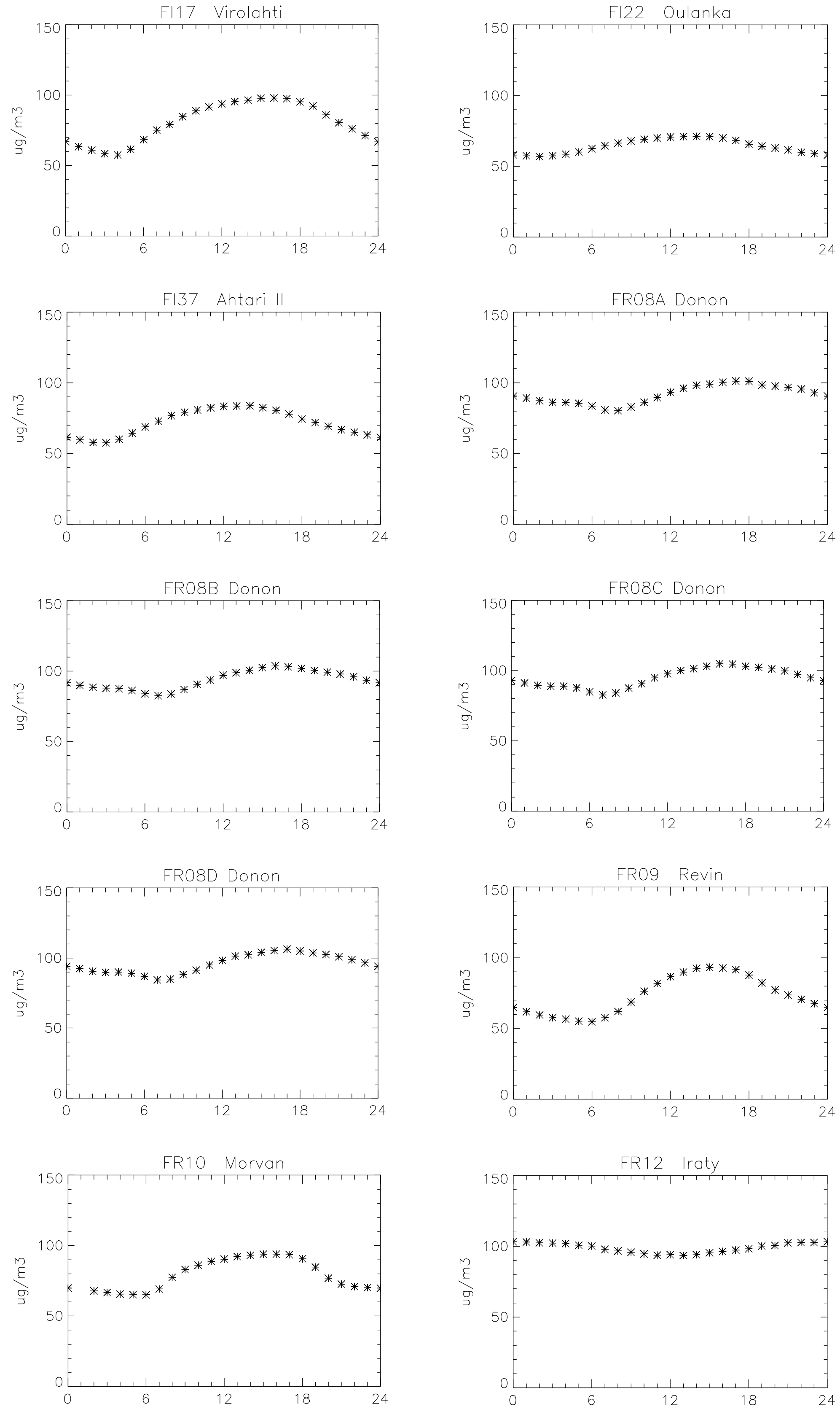

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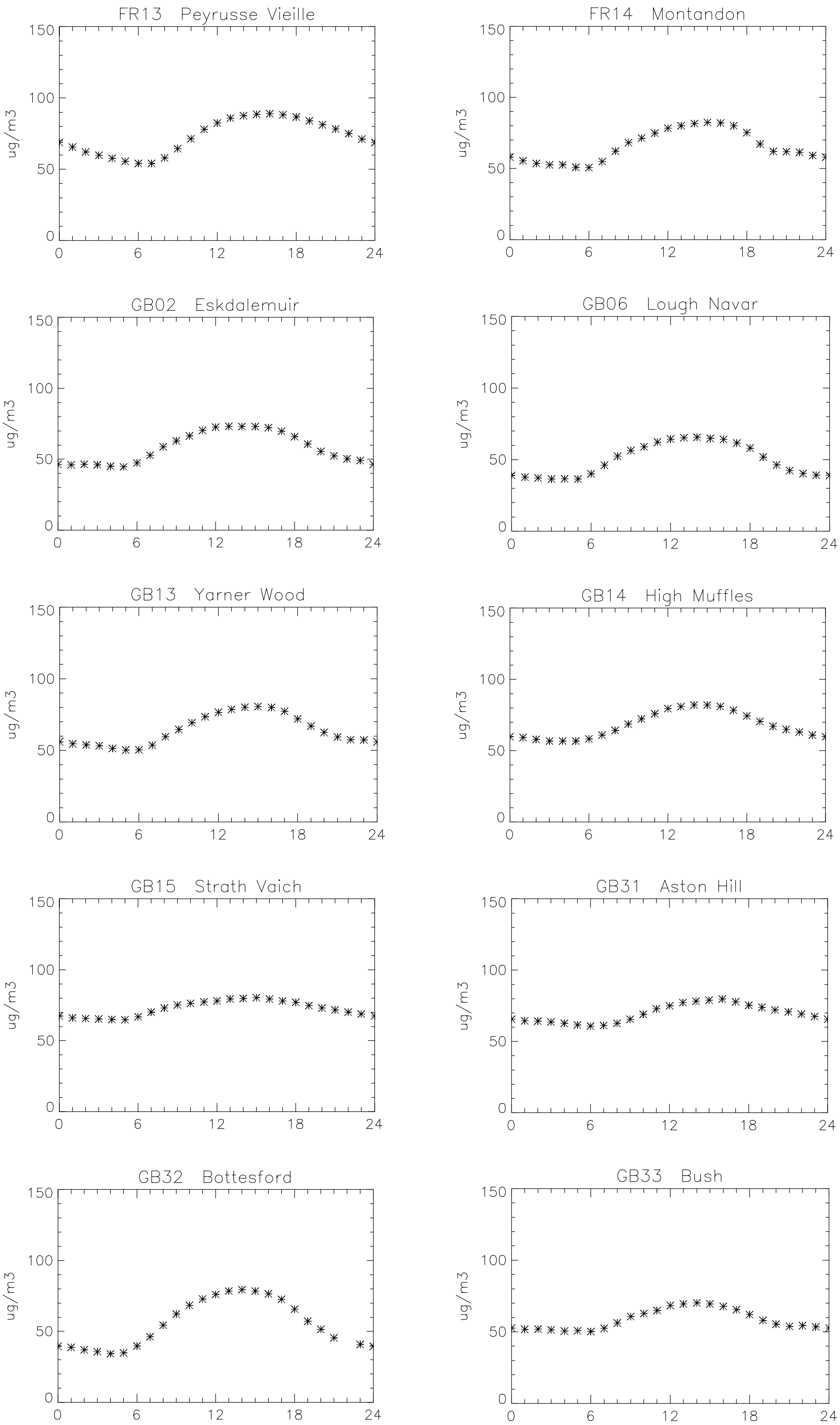

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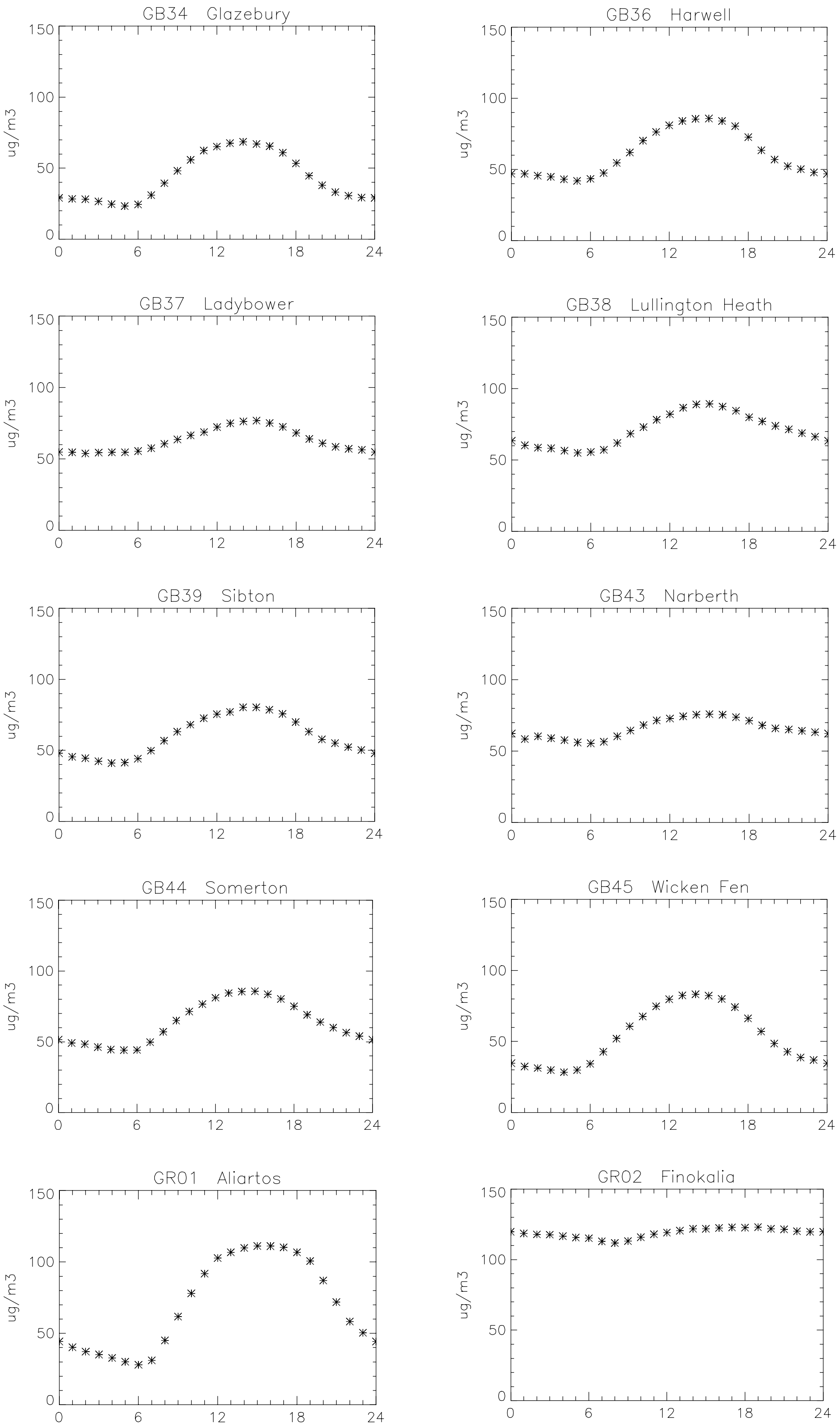

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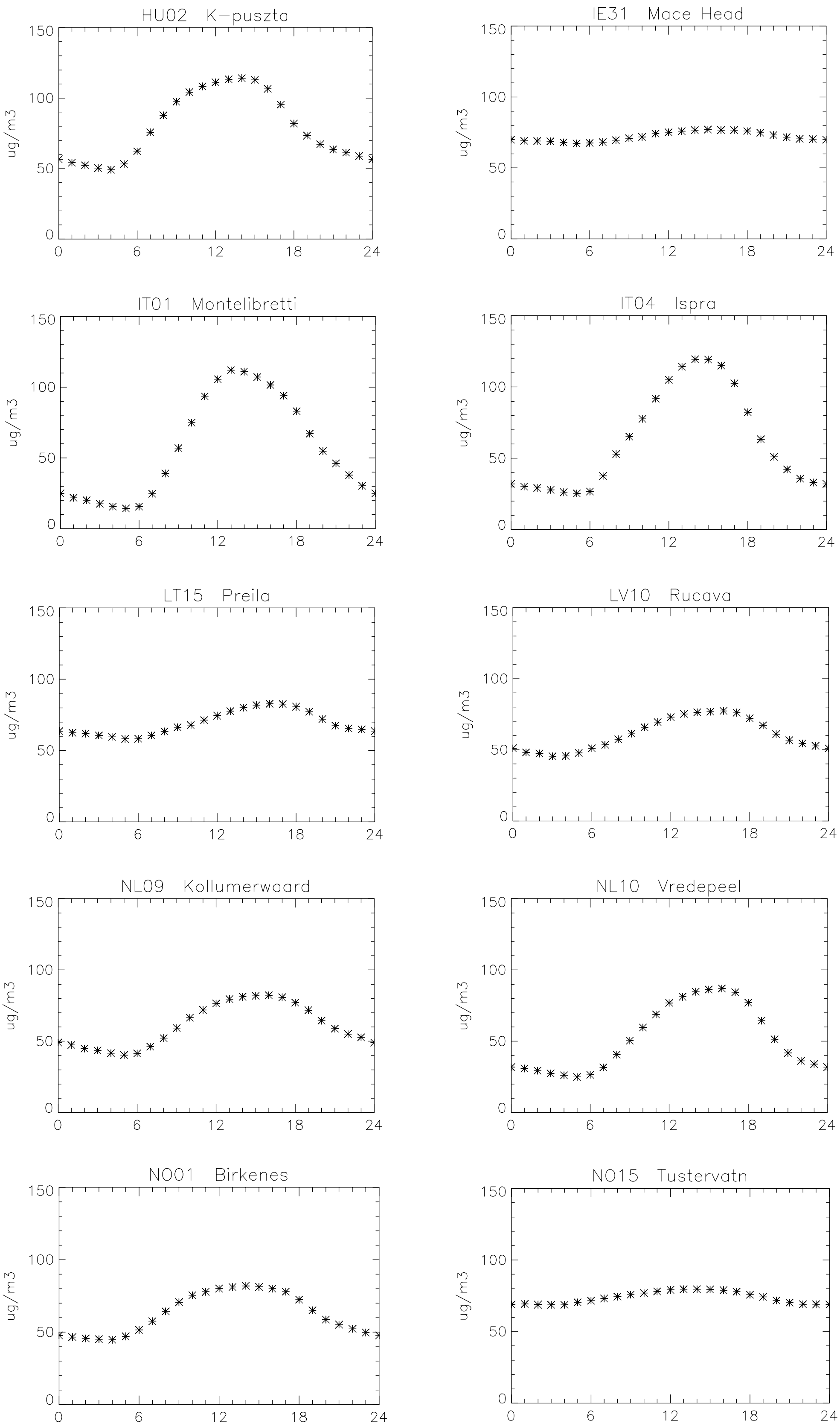

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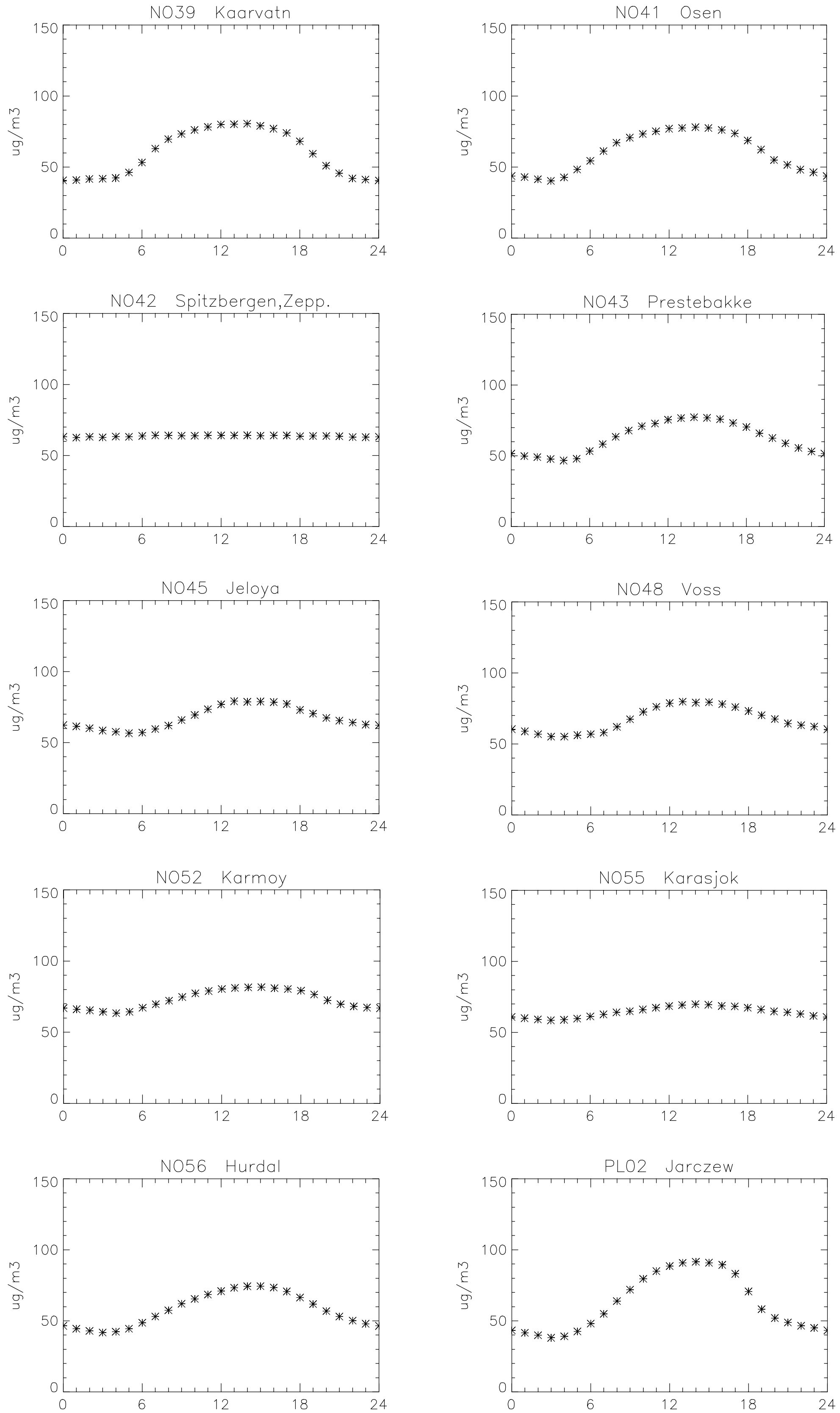

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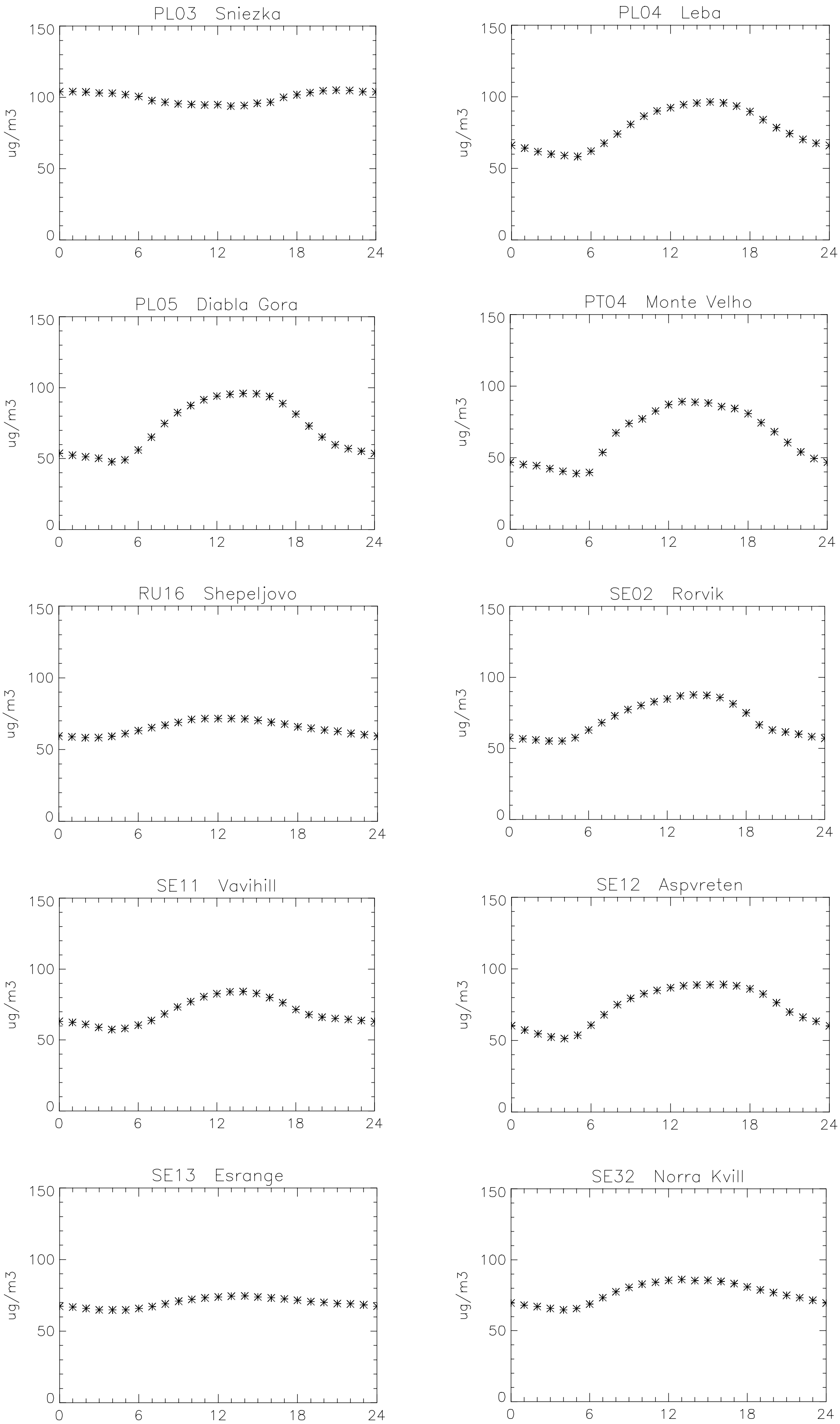

Figure 4.1, cont.

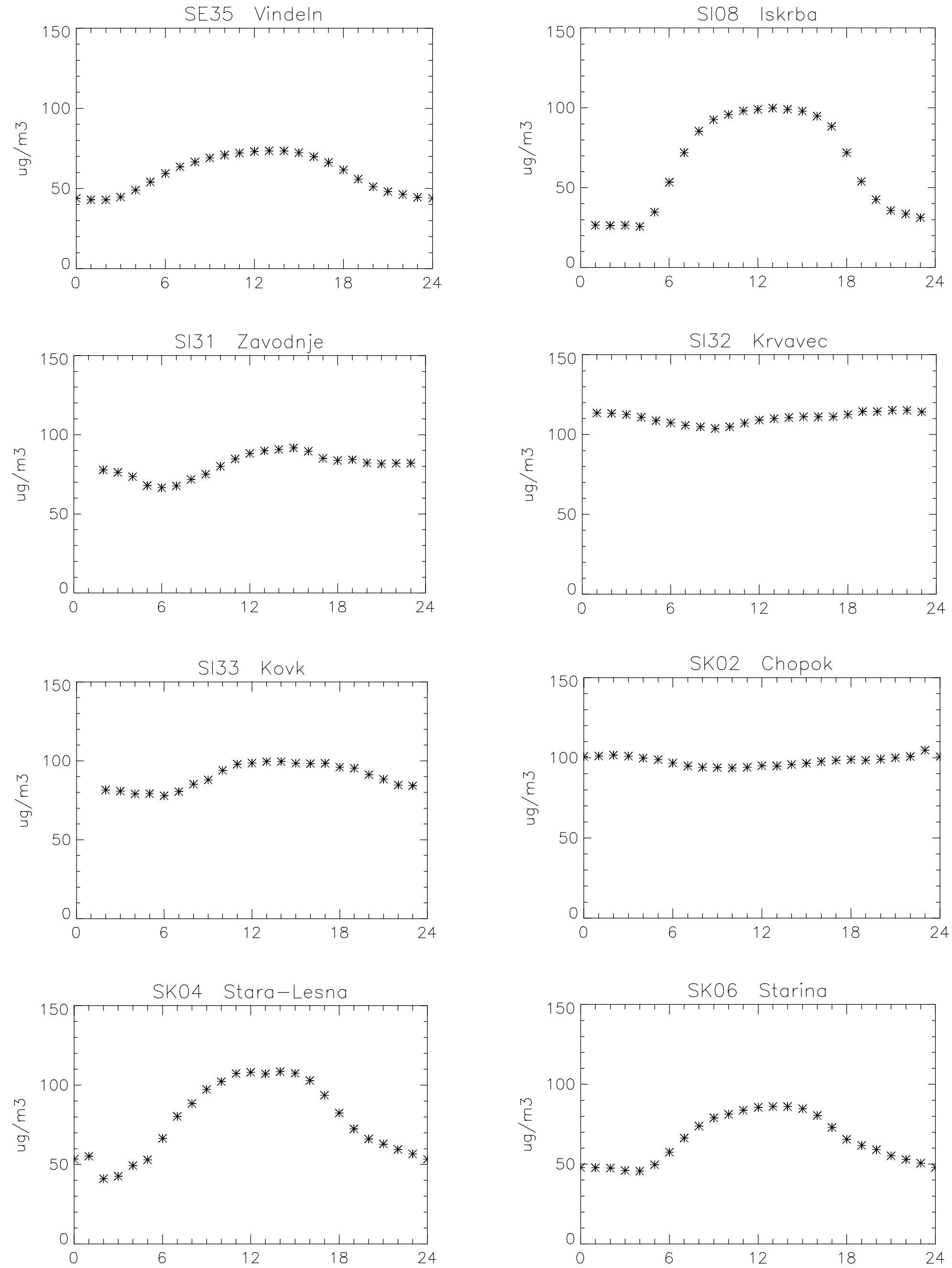

Figure 4.1, cont.