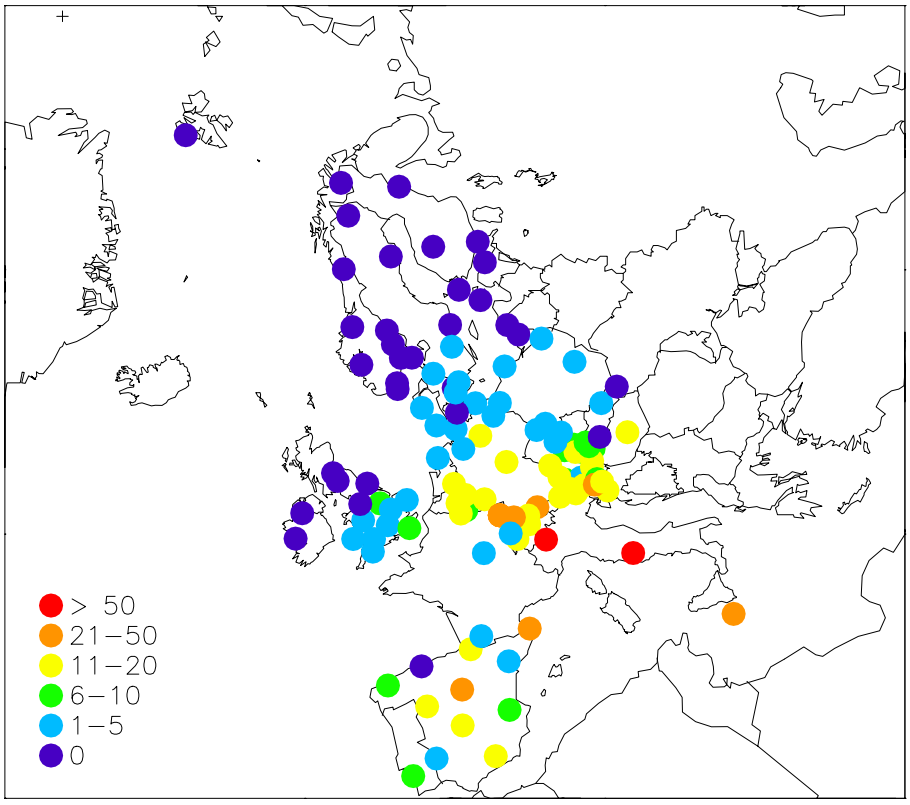
EMEP/CCC-Report 4/2003

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

Ozone measurements 2001

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 µg/m^3 for hourly mean, 60 µg/m^3 for eight-hour mean and 50 µg/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 µg/m^3 for hourly mean and 65 µg/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.

Work is currently in progress to revise the critical levels for ozone (level II) and was the focus of a UNECE Workshop in Gothenburg, November 2002. Although substantial progress was made, no final recommendations have yet been defined.

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, 1984; Grennfelt et al., 1988 and 1989).

This report presents surface ozone data measured at rural and background EMEP sites during 2001 with emphasis on statistical summaries and geographical distributions. Earlier reports are listed in Annex 5.

Table 1 and Figure 1 show the location of the monitoring stations reporting data from whole or part of 2001. In total 124 stations in 26 different countries reported data. One of these sites (Ispra) is operated by the Commission of the European Communities in Italy.

Table 1: List of EMEP ozone monitoring stations in operation 2001.

Code	Station	Country	Latitude	Longitude	Altitude (m)
AT0002R	Illmitz	Austria	47 46 00 N	16 46 00 E	117
AT0004R	St. Koloman	Austria	47 39 00 N	13 12 00 E	851
AT0005R	Vorhegg	Austria	46 40 40 N	12 58 20 E	1020
AT0030R	Pillersdorf bei Retz	Austria	48 43 16 N	15 56 32 E	315
AT0032R	Sulzberg	Austria	47 31 45 N	09 55 36 E	1020
AT0033R	Stolzalpe bei Murau	Austria	47 07 45 N	14 12 14 E	1302
AT0034G	Sonnblick	Austria	47 03 16 N	12 57 30 E	3106
AT0037R	Zillertaler Alpen	Austria	47 08 13 N	11 52 12 E	1970
AT0038R	Gerlitzen	Austria	46 41 37 N	13 54 54 E	1895
AT0040R	Masenberg	Austria	47 20 53 N	15 52 56 E	1170
AT0041R	Haunsberg	Austria	47 58 23 N	13 00 58 E	730
AT0042R	Heidenreichstein	Austria	48 52 43 N	15 02 48 E	570
AT0043R	Forsthof	Austria	48 06 22 N	15 55 10 E	581
AT0044R	Graz Platte	Austria	47 06 47 N	15 28 14 E	651
AT0045R	Dunkelsteinerwald	Austria	48 22 16 N	15 32 48 E	320
AT0046R	Gänserndorf	Austria	48 20 05 N	16 43 50 E	161
AT0047R	Stixneusiedl	Austria	48 03 03 N	16 40 36 E	240
BE0001R	Offagne	Belgium	49 52 40 N	05 12 13 E	430
BE0032R	Eupen	Belgium	50 37 46 N	06 00 10 E	295
BE0035R	Vezin	Belgium	50 30 12 N	04 59 22 E	160
CH0002R	Payerne	Switzerland	46 49 00 N	06 57 00 E	500
CH0003R	Tänikon	Switzerland	47 29 00 N	08 54 00 E	540
CH0004R	Chaumont	Switzerland	47 03 04 N	06 58 50 E	1130
CH0005R	Rigi	Switzerland	47 04 10 N	08 27 56 E	1028
CZ0001R	Svratouch	Czech Republic	49 44 00 N	16 02 00 E	737
CZ0003R	Kosetice	Czech Republic	49 35 00 N	15 05 00 E	534
DE0001R	Westerland	Germany	54 55 32 N	08 18 35 E	12
DE0002R	Langenbrügge	Germany	52 48 08 N	10 45 34 E	74
DE0003R	Schauinsland	Germany	47 54 53 N	07 54 31 E	1205
DE0004R	Deuselbach	Germany	49 45 53 N	07 03 07 E	480
DE0005R	Brotjacklriegel	Germany	48 49 10 N	13 13 09 E	1016
DE0007R	Neuglobsow	Germany	53 10 00 N	13 02 00 E	65
DE0008R	Schmücke	Germany	50 39 00 N	10 46 00 E	937
DE0009R	Zingst	Germany	54 26 00 N	12 44 00 E	1
DE0012R	Bassum	Germany	52 51 00 N	08 42 00 E	52
DE0017R	Ansbach	Germany	49 15 00 N	10 35 00 E	481
DE0026R	Ueckermünde	Germany	53 27 00 N	14 24 00 E	1
DE0035R	Lückendorf	Germany	50 50 00 N	14 46 00 E	490
DE0039R	Aukrug	Germany	54 02 24 N	09 28 48 E	15
DE0042R	Öhringen	Germany	49 14 32 N	09 26 50 E	283
DK0005R	Keldsnor	Denmark	54 44 00 N	10 44 00 E	10
DK0031R	Ulborg	Denmark	56 17 00 N	08 26 00 E	10
DK0032R	Frederiksborg	Denmark	55 58 00 N	12 20 00 E	10
DK0041R	Lille Valby	Denmark	55 41 13 N	12 07 34 E	10
EE0009R	Lahemaa	Estonia	59 30 00 N	25 54 00 E	32
EE0011R	Vilsandy	Estonia	58 23 00 N	21 49 00 E	6
ES0007R	Víznar	Spain	37 14 18 N	03 28 28 W	1230
ES0008R	Niembro	Spain	43 26 32 N	04 51 01 W	134
ES0009R	Campisabalos	Spain	41 16 52 N	03 08 34 W	1360
ES0010R	Cabo de Creus	Spain	42 19 10 N	03 19 01 E	23
ES0011R	Barcarrola	Spain	38 28 33 N	06 55 22 W	393
ES0012R	Zarra	Spain	39 05 10 N	01 06 07 W	885
ES0013R	Palma de Mallorca	Spain	41 17 00 N	05 52 00 W	985
ES0014R	Els Torms	Spain	41 24 00 N	00 43 00 E	470
ES0015R	Risco Llamo	Spain	39 31 00 N	04 21 00 W	1241
ES0016R	O Saviñao	Spain	43 13 52 N	07 41 59 W	506

Table 1, cont.

Code	Station	Country	Latitude	Longitude	Altitude (m)
FI0009R	Utö	Finland	59 46 45 N	21 22 38 E	7
FI0017R	Virolahti II	Finland	60 31 36 N	27 41 10 E	8
FI0022R	Oulanka	Finland	66 19 13 N	29 24 06 E	310
FI0037R	Ahtari II	Finland	62 35 00 N	24 11 00 E	180
FR0008R	Donon	France	48 30 00 N	07 08 00 E	775
FR0009R	Revin	France	49 54 00 N	04 38 00 E	390
FR0010R	Morvan	France	47 16 00 N	04 05 00 E	620
FR0012R	Iraty	France	43 02 00 N	01 05 00 W	1300
FR0013R	Peyrusse Vieille	France	43 22 29 N	00 06 16 E	236
FR0014R	Montandon	France	47 18 00 N	06 49 00 E	746
GB0002R	Eskdalemuir	United Kingdom	55 18 47 N	03 12 15 W	269
GB0006R	Lough Navar	United Kingdom	54 26 35 N	07 52 12 W	130
GB0013R	Yarner Wood	United Kingdom	50 35 47 N	03 42 47 W	119
GB0014R	High Muffles	United Kingdom	54 20 04 N	00 48 27 W	267
GB0015R	Strath Vaich Dam	United Kingdom	57 44 04 N	04 46 28 W	270
GB0031R	Aston Hill	United Kingdom	52 30 14 N	03 01 59 W	370
GB0032R	Bottesford	United Kingdom	52 55 46 N	00 48 55 W	32
GB0033R	Bush	United Kingdom	55 51 31 N	03 12 18 W	180
GB0034R	Glazebury	United Kingdom	53 27 31 N	02 27 59 W	21
GB0036R	Harwell	United Kingdom	51 34 23 N	01 19 00 W	137
GB0037R	Ladybower Res.	United Kingdom	53 23 56 N	01 45 12 W	420
GB0038R	Lullington Heath	United Kingdom	50 47 34 N	00 10 46 E	120
GB0039R	Sibton	United Kingdom	52 17 38 N	01 27 47 E	46
GB0043R	Narberth	United Kingdom	51 46 53 N	04 41 34 W	160
GB0044R	Somerton	United Kingdom	51 13 52 N	03 02 53 W	55
GB0045R	Wicken Fen	United Kingdom	52 17 54 N	00 17 34 W	5
GR0002R	Finokalia	Greece	35 19 00 N	25 40 00 E	150
HU0002R	K-puszta	Hungary	46 58 00 N	19 35 00 E	125
IE0031R	Mace Head	Ireland	53 10 00 N	09 30 00 W	15
IT0001R	Montelibretti	Italy	42 06 00 N	12 38 00 E	48
IT0004R	Ispra	Italy	45 48 00 N	08 38 00 E	209
LT0015R	Preila	Lithuania	55 21 00 N	21 04 00 E	5
LV0010R	Rucava	Latvia	56 13 00 N	21 13 00 E	5
MT0001R	Giordan lighthouse	Malta	36 06 00 N	14 12 00 E	160
NL0009R	Kollumerwaard	Netherlands	53 20 02 N	06 16 38 E	1
NL0010R	Vredepeel	Netherlands	51 32 28 N	05 51 13 E	28
NO0001R	Birkenes	Norway	58 23 00 N	08 15 00 E	190
NO0015R	Tustervatn	Norway	65 50 00 N	13 55 00 E	439
NO0039R	Kårvatn	Norway	62 47 00 N	08 53 00 E	210
NO0041R	Osen	Norway	61 15 00 N	11 47 00 E	440
NO0042G	Spitsbergen, Zeppelinfjell	Norway	78 54 00 N	11 53 00 E	474
NO0043R	Prestebakke	Norway	59 00 00 N	11 32 00 E	160
NO0045R	Jeløya	Norway	59 26 00 N	10 36 00 E	3
NO0048R	Voss	Norway	60 36 00 N	06 32 00 E	500
NO0052R	Sandve	Norway	58 05 00 N	07 51 00 E	15
NO0055R	Karasjok	Norway	69 28 00 N	25 13 00 E	333
NO0056R	Hurdal	Norway	60 22 00 N	11 04 00 E	300
PL0002R	Jarczew	Poland	51 49 00 N	21 59 00 E	180
PL0003R	Sniezka	Poland	50 44 00 N	15 44 00 E	1603
PL0004R	Leba	Poland	54 45 00 N	17 32 00 E	2
PL0005R	Diabla Gora	Poland	54 09 00 N	22 04 00 E	157
PT0004R	Monte Velho	Portugal	38 05 00 N	08 48 00 W	43
RU0016R	Shepeljovo	Russia	59 58 00 N	29 07 00 E	4
RU0018R	Danki	Russia	54 54 00 N	37 48 00 E	150

Table 1, cont.

Code	Station	Country	Latitude	Longitude	Altitude (m)
SE0002R	Rörvik	Sweden	57 25 00 N	11 56 00 E	10
SE0011R	Vavihill	Sweden	56 01 00 N	13 09 00 E	175
SE0012R	Aspvreten	Sweden	58 48 00 N	17 23 00 E	20
SE0013R	Esrange	Sweden	67 53 00 N	21 04 00 E	475
SE0032R	Norra-Kvill	Sweden	57 49 00 N	15 34 00 E	261
SE0035R	Vindeln	Sweden	64 15 00 N	19 46 00 E	225
SE0039R	Grimsö	Sweden			
SI0008R	Iskrba	Slovenia	45 34 00 N	14 52 00 E	520
SI0031R	Zarodnje	Slovenia	46 25 43 N	15 00 12 E	770
SI0032R	Krvavec	Slovenia	46 17 58 N	14 32 19 E	1740
SI0033R	Kovk	Slovenia	46 07 43 N	15 06 50 E	600
SK0004R	Stará Lesná	Slovakia	49 09 00 N	20 17 00 E	808
SK0006R	Starina	Slovakia	49 03 00 N	22 16 00 E	345
SK0007R	Topolniky	Slovakia	47 57 36 N	17 51 38 E	113

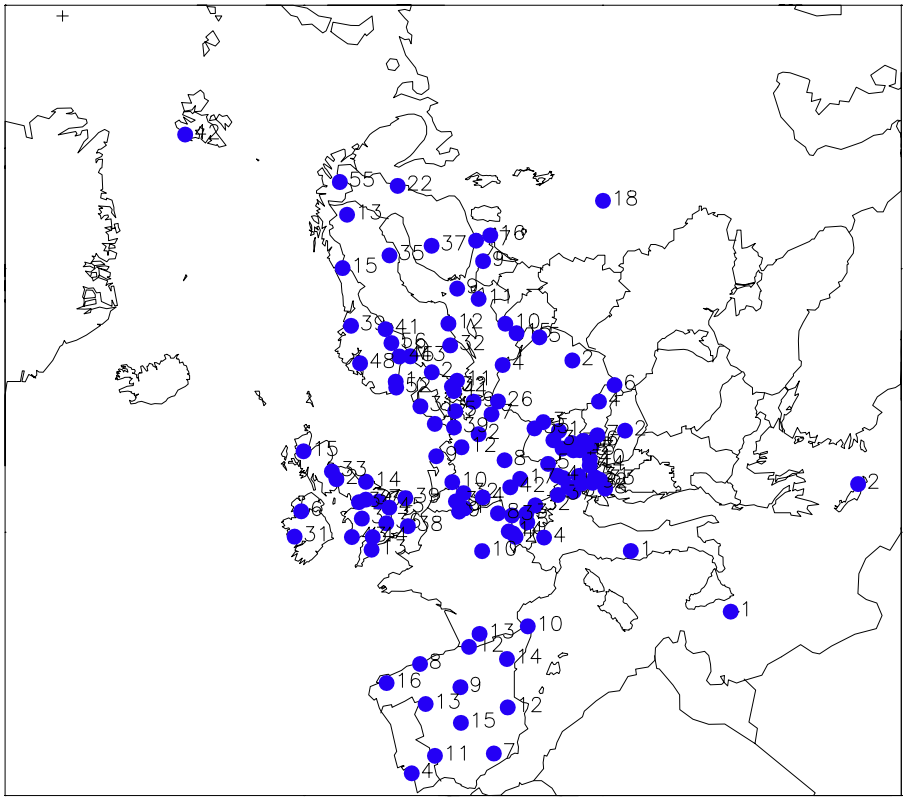

Figure 1: Location of the monitoring stations.

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 2001.

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
Greece (Finokalia)	reported in ppb
Hungary	2.0
Ireland (Mace Head)	reported in ppb
Italy (Ispra)	2.0
Italy (Montelibretti)	reported in ppb
Latvia	2.0
Lithuania	2.0
Netherlands	2.0
Norway	2.0
Poland	2.0
Portugal	1.96
Russia	2.0
Slovakia	reported in ppb
Slovenia	2.0
Spain	2.0
Sweden	2.0
Switzerland	1.96
United Kingdom	reported in ppb

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 2001 more than 100 stations had a capture above 90%.

Table 3: Data capture in per cent, 2001.

Code	Station	Data capture 2001
AT0002R	Illmitz	96.2
AT0004R	St. Koloman	93.7
AT0005R	Vorhegg	96.0
AT0030R	Pillersdorf bei Retz	95.7
AT0032R	Sulzberg	99.1
AT0033R	Stolzalpe bei Murau	93.0
AT0034G	Sonnblick	93.0
AT0037R	Zillertaler Alpen	94.0
AT0038R	Gerlitzen	97.0
AT0040R	Masenberg	95.1
AT0041R	Haunsberg	99.2
AT0042R	Heidenreichstein	95.2
AT0043R	Forsthof	95.2
AT0044R	Graz Platte	85.3
AT0045R	Dunkelsteinerwald	95.1
AT0046R	Gänserndorf	92.5
AT0047R	Stixneusiedl	96.6
BE0001R	Offagne	92.5
BE0032R	Eupen	93.3
BE0035R	Vezin	94.0
CH0002R	Payerne	94.7
CH0003R	Tänikon	95.1
CH0004R	Chaumont	95.2
CH0005R	Rigi	93.4
CZ0001R	Svratouch	98.1
CZ0003R	Kosetice	98.5
DE0001R	Westerland	88.3
DE0002R	Langenbrügge	92.4
DE0003R	Schauinsland	95.2
DE0004R	Deuselbach	94.8
DE0005R	Brotjacklriegel	95.9
DE0007R	Neuglobsow	95.6
DE0008R	Schmücke	95.5
DE0009R	Zingst	96.7
DE0012R	Bassum	77.0
DE0017R	Ansbach	4.4
DE0026R	Ueckermünde	92.0
DE0035R	Lückendorf	93.0
DE0039R	Aukrug	90.4
DE0042R	Öhringen	40.0
DK0005R	Keldsnor	99.4
DK0031R	Ulborg	96.5
DK0032R	Frederiksborg	94.8
DK0041R	Lille Valby	98.3
EE0009R	Lahemaa	98.5
EE0011R	Vilsandy	95.3
ES0007R	Víznar	97.1
ES0008R	Niembro	97.8
ES0009R	Campisabalos	97.2
ES0010R	Cabo de Creus	95.6
ES0011R	Barcarrola	97.6

Table 3, cont.

Code	Station	Data capture 2001
ES0012R	Zarra	98.5
ES0013R	Palma de Mallorca	97.3
ES0014R	Els Torms	97.8
ES0015R	Risco Llamo	94.9
ES0016R	O Saviñao	79.7
FI0009R	Utö	79.9
FI0017R	Virolahti II	75.8
FI0022R	Oulanka	96.5
FI0037R	Ahtari II	96.9
FR0008A	Donon	97.7
FR0008B	Donon	97.7
FR0008C	Donon	91.7
FR0008D	Donon	99.2
FR0009R	Revin	96.1
FR0010R	Morvan	97.3
FR0012R	Iraty	91.6
FR0013R	Peyrusse Vieille	96.5
FR0014R	Montandon	86.1
GB0002R	Eskdalemuir	99.3
GB0006R	Lough Navar	98.9
GB0013R	Yarner Wood	96.4
GB0014R	High Muffles	79.4
GB0015R	Strath Vaich Dam	58.5
GB0031R	Aston Hill	82.3
GB0032R	Bottesford	99.4
GB0033R	Bush	98.2
GB0034R	Glazebury	97.7
GB0036R	Harwell	96.8
GB0037R	Ladybower Res.	53.6
GB0038R	Lullington Heath	97.2
GB0039R	Sibton	98.9
GB0043R	Narberth	93.7
GB0044R	Somerton	97.6
GB0045R	Wicken Fen	90.7
GR0002R	Finokalia	74.7
HU0002R	K-puszta	92.9
IE0031R	Mace Head	99.3
IT0001R	Montelibretti	90.6
IT0004R	Ispra	98.7
LT0015R	Preila	98.9
LV0010R	Rucava	80.4
MT0001R	Giordan lighthouse	92.9
NL0009R	Kollumerwaard	90.6
NL0010R	Vredepeel	91.4
NO0001R	Birkenes	99.4
NO0015R	Tustervatn	99.9
NO0039R	Kårvatn	99.4
NO0041R	Osen	98.8
NO0042G	Spitsbergen, Zeppelinfjell	96.7
NO0043R	Prestebakke	98.5
NO0045R	Jeløya	97.8
NO0048R	Voss	99.4
NO0052R	Sandve	99.7
NO0055R	Karasjok	99.9
NO0056R	Hurdal	96.7

Table 3, cont.

Code	Station	Data capture 2001
PL0002R	Jarczew	99.7
PL0003R	Sniezka	99.7
PL0004R	Leba	99.9
PL0005R	Diabla Gora	96.6
PT0004R	Monte Velho	93.3
RU0016R	Shepeljovo	70.6
RU0018R	Danki	49.5
SE0002R	Rörvik	97.5
SE0011R	Vavihill	99.7
SE0012R	Aspvreten	87.9
SE0013R	Esrange	99.8
SE0032R	Norra-Kvill	95.8
SE0035R	Vindeln	99.6
SE0039R	Grimsö	96.3
SI0008R	Iskrba	89.5
SI0031R	Zarodnje	89.1
SI0032R	Krvavec	94.0
SI0033R	Kovk	84.4
SK0004R	Stará Lesná	98.0
SK0006R	Starina	97.0
SK0007R	Topolniky	77.8

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 2001. The number of hours and days the ozone concentrations exceed 120, 150, 180 and 200 µg/m^3 and the maxima are given. The highest hourly mean values was found at the two Italian sites Montelibretti (251 µg/m^3, 3 August) and Ispra (284 µg/m^3, 1 August). Values above 200 µg/m^3 were during 2001 measured 14 sites in Central Europe, mainly during an ozone episode around 26 June. The lowest maximum values were observed at Spitsbergen, Zeppelin (106 µg/m^3, 17 April).

The one hour critical level for ozone formulated by the ECE for protection of vegetation, 150 µg/m^3, was in 2001 exceeded at 85 sites (Figure 1.3). In the central parts of Europe the exceedances were considerable, and at Ispra this limit was exceeded 62 days during 2001.

Figure 1.4 shows the number of exceedances of the threshold value of 180 µg/m^3 formulated by the EU for informing the public. Two sites, Ispra and Montelibretti, exceeds the threshold value more than 20 days. The data are in good agreement with data submitted to the European Commission under Directive 92/72/EEC on air pollution by ozone (de Leeuw et. al., 2001).

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, Scotland and Scandinavia, 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, where the 99-percentile generally ranges from 150-170 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 are 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 a simple approach have been used for the calculations in this report, defining daylight as solar zenith angle less that 80°.

AOT40 and AOT60 for forests and agricultural crops for 2001 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 Austria, Hungary, Slovenia and on Malta.

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 2001 exceeded at most stations in central Europe.

7. Seasonal variation

Monthly mean concentrations for 2001 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 1990–2001 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) 2001 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 18 June, 2003.

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.

10. References

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11. List of participating institutions

Austria	Umweltbundesamt Provincial Government of Tyrol Provincial Government of Carinthia Environment Institute Vorarlberg Provincial Government Styria Provincial Government Salzburg Provincial Government Lower Austria
Belgium	CELINE – IRCEL
Commission of the European Communities	Joint Research Center. Ispra Establishment
Czech Republic	Czech Hydrometeorological Institute
Denmark	National Environmental Research Institute
Finland	Finnish Meteorological Institute
France	l' Ecole des Mines de Douai Laboratories Wolff
Germany	Umweltbundesamt
Greece	Environmental Chemical Processes Laboratory, University of Crete
Hungary	Institute for Atmospheric Physics, Dep. for Air Chemistry
Italy	C.N.R. Istituto Inquinamento Atmosferico
Latvia	Latvian Hydrometeorological Agency
Lithuania	Institute of Physics
Netherlands	National Institute for Public Health and Environmental Protection (RIVM)
Norway	Norwegian Institute for Air Research (NILU)
Poland	Institute of Meteorology and Water Management Institute of Environmental Protection
Portugal	Ministério do ambiente e recursos naturais
Russian Federation	Institute of Global Climate and Ecology
Slovakia	Slovak Hydrometeorological Institute
Slovenia	Hydrometeorological Institute of Slovenia
Spain	Dirección General de Calidad y Evaluacíon Ambiental
Sweden	Swedish Environmental Research Institute (IVL)
Switzerland	Swiss Federal Laboratory of Testing Materials and Research (EMPA)
United Kingdom	AEA Technology

Annex 1

Concentration summaries and episodes, tables and figures

Table 1.1: Number of hours (h) and days (d) exceeding 120, 150, 180 and 200 μg/m³ and maximum concentrations in 2001.

Code	Station	Total		>120		>150		>180		>200		Max. concentration	
		hours	days	hours	days	hours	days	hours	days	hours	days	μg/m³	date(s)
AT0002R	Illmitz	8426	365	397	63	27	9	0	0	0	0	174	1.8.01
AT0004R	St. Koloman	8206	361	457	52	44	6	0	0	0	0	171	31.7.01, 1.8.01
AT0005R	Vorhegg	8407	365	408	63	63	12	3	2	0	0	186	2.8.01
AT0030R	Pillersdorf bei Retz	8382	365	331	54	19	8	1	1	0	0	189	3.8.01
AT0032R	Sulzberg	8680	364	832	81	167	23	3	1	0	0	198	31.7.01
AT0033R	Stolzalpe bei Murau	8145	356	283	44	11	4	0	0	0	0	164	3.8.01
AT0034G	Sonnblick	8145	355	1526	131	61	16	0	0	0	0	168	30.7.01
AT0037R	Zillertaler Alpen	8234	359	1208	111	54	11	0	0	0	0	175	15.6.01
AT0038R	Gerlitzen	8500	365	1394	115	117	17	2	1	0	0	182	3.8.01
AT0040R	Masenberg	8335	365	930	82	47	14	0	0	0	0	177	3.8.01
AT0041R	Haunsberg	8692	364	606	69	103	17	5	2	0	0	192	16.8.01
AT0042R	Heidenreichstein	8340	364	327	54	26	9	1	1	0	0	181	3.8.01
AT0043R	Forsthof	8342	364	440	55	30	8	0	0	0	0	179	14.8.01
AT0044R	Graz Platte	7471	327	863	78	97	20	2	1	0	0	182	3.8.01
AT0045R	Dunkelsteinerwald	8328	364	428	64	84	20	13	5	0	0	200	27.6.01
AT0046R	Gänserndorf	8106	357	312	56	25	8	0	0	0	0	180	3.8.01
AT0047R	Stixneusiedl	8466	364	361	56	25	9	1	1	0	0	183	31.7.01
BE0001R	Offagne	8099	352	225	32	41	9	8	2	2	1	207	26.6.01
BE0032R	Eupen	8176	353	237	32	78	16	2	2	0	0	183	27.6.01
BE0035R	Vezin	8235	356	236	36	71	16	3	2	0	0	185	26.6.01
CH0002R	Payerne	8299	364	299	51	36	11	0	0	0	0	171	6.7.01
CH0003R	Tänikon	8328	365	313	53	62	16	2	1	0	0	192	31.7.01
CH0004R	Chaumont	8341	365	731	66	137	20	8	3	0	0	196	26.6.01
CH0005R	Rigi	8181	360	626	63	106	19	10	4	0	0	190	26.6.01
CZ0001R	Svratouch	8597	362	249	36	6	3	0	0	0	0	160	25.8.01
CZ0003R	Kosetice	8626	362	208	34	1	1	0	0	0	0	155	26.6.01
DE0001R	Westerland	7734	335	91	16	15	3	1	1	0	0	183	25.8.01
DE0002R	Langenbrügge	8092	363	188	27	48	11	0	0	0	0	175	24.8.01, 26.8.01
DE0003R	Schauinsland	8341	365	756	68	188	24	18	5	6	1	236	26.6.01
DE0004R	Deuselbach	8304	365	331	41	72	16	8	3	0	0	192	26.6.01

Table 1.1, cont.

Code	Station	Total		>120		>150		>180		>200		Max. concentration	
		hours	days	hours	days	hours	days	hours	days	hours	days	μg/m^3	date(s)
DE0005R	Brotjacklriegel	8403	364	627	65	73	11	3	1	0	0	188	31.7.01
DE0007R	Neuglobsow	8372	365	71	20	6	2	1	1	0	0	184	16.8.01
DE0008R	Schmücke	8365	365	519	49	141	17	10	3	0	0	195	31.7.01
DE0009R	Zingst	8468	365	33	8	3	1	0	0	0	0	167	16.8.01
DE0012R	Bassum	6748	301	57	12	12	4	0	0	0	0	178	15.8.01
DE0017R	Ansbach	384	17	0	0	0	0	0	0	0	0	56	6.1.01, 7.1.01
DE0026R	Ueckermünde	8060	359	67	15	8	3	0	0	0	0	170	16.8.01
DE0035R	Lückendorf	8148	360	37	8	5	1	0	0	0	0	159	31.7.01
DE0039R	Aukrug	7922	358	56	10	10	4	0	0	0	0	166	15.8.01
DE0042R	Öhringen	3501	154	221	37	42	9	2	1	0	0	187	27.6.01
DK0005R	Keldsnor	8709	365	14	3	0	0	0	0	0	0	143	26.8.01
DK0031R	Ulborg	8455	355	47	10	5	1	1	1	0	0	181	25.8.01
DK0032R	Frederiksborg	8305	349	0	0	0	0	0	0	0	0	118	20.6.01
DK0041R	Lille Valby	8614	362	10	2	2	1	0	0	0	0	169	16.8.01
EE0009R	Lahemaa	8632	363	49	13	0	0	0	0	0	0	149	25.7.01
EE0011R	Vilsandy	8350	355	20	6	0	0	0	0	0	0	144	26.7.01
ES0007R	Víznar	8506	365	501	69	34	12	1	1	0	0	181	31.5.01
ES0008R	Niembro	8566	365	3	2	0	0	0	0	0	0	139	20.6.01
ES0009R	Campisabalos	8515	365	865	98	184	33	21	9	6	2	223	26.7.01
ES0010R	Cabo de Creus	8374	363	926	106	155	31	21	10	1	1	202	2.7.01
ES0011R	Barcarrola	8554	365	46	13	1	1	0	0	0	0	153	22.6.01
ES0012R	Zarra	8630	365	523	84	30	10	0	0	0	0	175	1.6.01
ES0013R	Palma de Mallorca	8525	365	541	76	36	11	0	0	0	0	176	22.6.01
ES0014R	Els Torms	8570	365	258	50	2	1	0	0	0	0	156	29.7.01
ES0015R	Risco Llamo	8313	363	1068	106	62	12	0	0	0	0	175	1.6.01, 21.6.01
ES0016R	O Saviñao	6985	305	158	31	23	7	0	0	0	0	178	20.6.01
FI0009R	Utö	7002	298	12	4	0	0	0	0	0	0	133	18.7.01
FI0017R	Virolahti II	6639	279	3	2	0	0	0	0	0	0	125	9.7.01
FI0022R	Oulanka	8457	358	5	1	0	0	0	0	0	0	123	30.3.01
FI0037R	Ahtari II	8487	359	0	0	0	0	0	0	0	0	116	3.5.01, 8.6.01

Table 1.1, cont.

Code	Station	Total		>120		>150		>180		>200		Max. concentration	
		hours	days	hours	days	hours	days	hours	days	hours	days	μg/m^3	date(s)
FR0008A	Donon	8557	365	684	58	194	24	21	6	8	2	218	26.6.01
FR0008B	Donon	8559	365	713	64	208	27	23	7	9	1	221	26.6.01
FR0008C	Donon	8034	339	740	64	221	29	23	7	8	1	218	26.6.01
FR0008D	Donon	8686	365	791	64	252	28	24	7	12	2	220	26.6.01
FR0009R	Revin	8422	355	280	35	68	14	10	2	1	1	220	26.6.01
FR0010R	Morvan	8524	363	106	18	10	4	0	0	0	0	167	26.6.01
FR0012R	Iraty	8026	347	388	57	54	12	2	2	0	0	186	23.6.01
FR0013R	Peyrusse Vieille	8451	356	64	14	2	1	0	0	0	0	154	25.6.01
FR0014R	Montandon	7542	324	125	25	11	4	0	0	0	0	162	6.7.01
GB0002R	Eskdalemuir	8701	365	10	2	0	0	0	0	0	0	132	12.5.01
GB0006R	Lough Navar	8661	364	25	5	0	0	0	0	0	0	140	12.5.01
GB0013R	Yarner Wood	8449	355	60	9	17	4	0	0	0	0	174	25.6.01
GB0014R	High Muffles	6955	296	59	14	0	0	0	0	0	0	150	4.7.01
GB0015R	Strath Vaich Dam	5123	217	11	4	0	0	0	0	0	0	136	25.5.01
GB0031R	Aston Hill	7213	305	53	9	15	3	3	1	0	0	192	26.6.01
GB0032R	Bottesford	8705	365	72	13	28	6	1	1	0	0	182	25.6.01
GB0033R	Bush	8604	363	7	2	0	0	0	0	0	0	146	23.5.01
GB0034R	Glazebury	8558	362	17	4	0	0	0	0	0	0	150	4.7.01
GB0036R	Harwell	8477	360	65	14	18	4	8	2	4	2	210	25.6.01
GB0037R	Ladybower Res.	4698	202	11	2	0	0	0	0	0	0	148	29.7.01
GB0038R	Lullington Heath	8516	364	129	20	37	7	9	2	0	0	198	26.6.01
GB0039R	Sibton	8666	365	49	11	8	4	0	0	0	0	170	15.8.01
GB0043R	Narberth	8206	358	37	11	3	1	0	0	0	0	172	26.6.01
GB0044R	Somerton	8548	363	70	14	20	4	5	1	1	1	206	25.6.01
GB0045R	Wicken Fen	7942	339	100	19	15	4	1	1	0	0	182	26.6.01
GR0002R	Finokalia	6544	301	765	67	0	0	0	0	0	0	148	25.8.01
HU0002R	K-puszta	8137	349	495	82	32	11	2	1	0	0	195	1.8.01
IE0031R	Mace Head	8702	365	24	6	0	0	0	0	0	0	130	11.5.01, 22.5.01, 23.5.01
IT0001R	Montelibretti	7940	349	716	120	243	62	71	27	26	13	251	3.8.01
IT0004R	Ispra	8645	365	508	92	210	54	62	21	24	9	284	1.8.01

Table 1.1, cont.

Code	Station	Total		>120		>150		>180		>200		Max. concentration	
		hours	days	hours	days	hours	days	hours	days	hours	days	$\mu g/m^3$	date(s)
LT0015R	Preila	8664	363	15	4	0	0	0	0	0	0	137	3.4.01, 17.8.01
LV0010R	Rucava	7046	304	0	0	0	0	0	0	0	0	116	16.8.01
MT0001R	Giordan lighthouse	8141	344	1635	143	108	25	0	0	0	0	179	9.7.01
NL0009R	Kollumerwaard	7938	338	19	6	7	2	0	0	0	0	172	15.8.01
NL0010R	Vredepeel	8011	349	159	29	47	12	7	2	3	1	213	26.6.01
NO0001R	Birkenes	8704	365	1	1	0	0	0	0	0	0	124	18.5.01
NO0015R	Tustervatn	8755	365	1	1	0	0	0	0	0	0	123	3.5.01
NO0039R	Kårvatn	8708	365	11	3	0	0	0	0	0	0	126	25.4.01
NO0041R	Osen	8655	365	0	0	0	0	0	0	0	0	118	22.4.01
NO0042G	Spitsbergen, Zeppelinfjell	8469	359	0	0	0	0	0	0	0	0	106	17.4.01
NO0043R	Prestebakke	8629	362	21	7	0	0	0	0	0	0	144	16.8.01
NO0045R	Jeløya	8568	358	0	0	0	0	0	0	0	0	120	7.7.01
NO0048R	Voss	8706	364	0	0	0	0	0	0	0	0	118	22.4.01, 15.5.01
NO0052R	Sandve	8735	365	6	3	0	0	0	0	0	0	139	16.8.01
NO0055R	Karasjok	8749	365	0	0	0	0	0	0	0	0	118	29.4.01
NO0056R	Hurdal	8473	357	6	2	0	0	0	0	0	0	129	6.7.01
PL0002R	Jarczew	8732	365	116	23	4	1	0	0	0	0	165	20.8.01
PL0003R	Sniezka	8734	365	438	62	8	4	0	0	0	0	156	25.8.01
PL0004R	Leba	8752	365	67	16	2	2	1	1	1	1	999	14.9.01
PL0005R	Diabla Gora	8458	358	56	15	1	1	0	0	0	0	154	27.8.01
PT0004R	Monte Velho	8171	362	231	45	30	8	8	2	4	1	230	28.5.01
RU0016R	Shepeljovo	6186	271	16	5	1	1	0	0	0	0	160	25.7.01
RU0018R	Danki	4336	183	5	3	0	0	0	0	0	0	132	24.7.01
SE0002R	Rörvik	8541	361	49	16	4	1	0	0	0	0	174	16.8.01
SE0011R	Vavihill	8737	365	41	10	5	1	0	0	0	0	166	16.8.01
SE0012R	Aspvreten	7703	344	12	4	0	0	0	0	0	0	148	16.8.01
SE0013R	Esrange	8745	365	1	1	0	0	0	0	0	0	123	30.4.01

Table 1.1, cont.

Code	Station	Total		>120		>150		>180		>200		Max. concentration	
		hours	days	hours	days	hours	days	hours	days	hours	days	$\mu g/m^3$	date(s)
SE0032R	Norra-Kvill	8392	358	35	10	3	1	0	0	0	0	159	16.8.01
SE0035R	Vindeln	8723	365	4	1	0	0	0	0	0	0	124	1.6.01
SE0039R	Grimsö	8437	354	0	0	0	0	0	0	0	0	115	8.7.01
SI0008R	Iskrba	7839	363	587	81	89	20	4	1	0	0	197	29.5.01
SI0031R	Zarodnje	7806	364	529	71	32	8	0	0	0	0	171	1.8.01
SI0032R	Krvavec	8231	358	1161	109	161	25	7	4	0	0	195	27.6.01
SI0033R	Kovk	7396	355	545	68	71	13	6	3	0	0	197	30.5.01
SK0004R	Stará Lesná	8589	361	287	47	7	2	0	0	0	0	164	4.4.01
SK0006R	Starina	8501	356	75	23	0	0	0	0	0	0	150	2.4.01
SK0007R	Topolniky	6818	310	41	9	0	0	0	0	0	0	147	3.8.01

Table 1.2: Percentiles of hourly ozone values April–September 2001.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
AT0002R	Illmitz	58.0	75.0	96.0	119.0	131.0	141.0	146.4	97.1
AT0004R	St. Koloman	75.0	91.0	106.0	122.0	133.0	144.0	151.0	94.6
AT0005R	Vorhegg	70.0	87.0	104.0	120.0	133.0	146.7	158.0	96.0
AT0030R	Pillersdorf bei Retz	59.4	76.4	94.9	116.6	127.4	137.6	144.6	95.8
AT0032R	Sulzberg	79.0	98.0	115.0	132.4	146.0	156.0	160.0	99.9
AT0033R	Stolzalpe bei Murau	67.0	85.0	101.2	115.2	124.4	132.8	138.4	94.5
AT0034G	Sonnblick	100.6	113.0	125.4	134.2	139.8	147.7	151.0	89.4
AT0037R	Zillertaler Alpen	91.6	106.4	121.6	133.8	139.2	146.4	151.0	95.8
AT0038R	Gerlitzen	98.6	111.8	124.2	137.0	142.8	154.4	163.4	97.0
AT0040R	Masenberg	86.8	100.0	118.2	133.6	140.2	147.2	150.9	94.8
AT0041R	Haunsberg	69.0	87.0	106.0	127.0	138.0	153.0	159.2	99.8
AT0042R	Heidenreichstein	51.0	72.0	93.0	116.0	129.0	139.0	147.0	95.7
AT0043R	Forsthof	64.0	82.0	102.0	121.3	131.0	139.1	147.0	95.6
AT0044R	Graz Platte	85.8	102.2	121.0	137.6	146.2	153.2	160.6	75.4
AT0045R	Dunkelsteinerwald	51.0	70.0	93.0	121.0	137.0	150.1	158.1	95.5
AT0046R	Gänserndorf	47.0	65.0	88.0	114.0	129.0	141.0	147.8	96.2
AT0047R	Stixneusiedl	55.0	72.0	95.0	117.0	130.0	139.0	144.0	98.7
BE0001R	Offagne	48.0	65.0	85.0	108.0	123.0	138.0	150.1	93.0
BE0032R	Eupen	46.0	64.0	83.0	106.0	124.0	149.0	157.7	94.0
BE0035R	Vezin	35.0	56.0	78.5	101.0	124.0	147.0	159.0	94.9
CH0002R	Payerne	47.0	69.0	90.0	114.0	129.0	143.0	149.0	95.3
CH0003R	Tänikon	49.0	67.0	90.0	113.0	130.0	145.0	157.4	94.8
CH0004R	Chaumont	77.0	91.0	111.0	132.0	145.0	157.0	163.0	95.3
CH0005R	Rigi	75.0	92.0	111.0	129.0	140.0	153.8	165.0	92.4
CZ0001R	Svratouch	61.0	76.0	96.0	113.0	122.0	132.0	137.6	96.6
CZ0003R	Kosetice	52.0	69.0	89.0	110.0	120.0	129.0	135.0	97.0
DE0001R	Westerland	65.0	79.0	90.0	101.0	109.0	125.0	135.5	80.8
DE0002R	Langenbrügge	44.0	64.0	85.0	105.0	119.0	142.0	153.0	92.0
DE0003R	Schauinsland	77.0	92.0	111.0	134.0	149.0	163.0	171.0	96.5
DE0004R	Deuselbach	56.0	73.0	91.0	116.0	130.0	147.0	156.0	95.7
DE0005R	Brotjacklriegel	70.0	89.0	110.0	126.0	135.0	149.0	156.1	95.3
DE0007R	Neuglobsow	37.0	58.0	78.0	95.0	105.0	118.0	126.0	95.7
DE0008R	Schmücke	67.0	83.0	103.0	125.0	142.0	158.0	165.0	95.5
DE0009R	Zingst	53.0	67.0	81.0	92.0	100.0	110.0	119.7	96.2
DE0012R	Bassum	35.0	51.0	69.0	88.0	99.0	117.0	131.7	75.5
DE0026R	Ueckermünde	48.0	65.0	82.0	95.0	104.0	118.0	128.0	91.2
DE0035R	Lückendorf	48.0	61.0	79.0	95.0	103.0	113.0	119.0	92.1
DE0039R	Aukrug	41.0	58.0	73.0	88.0	100.0	115.4	129.7	91.7
DE0042R	Öhringen	41.0	60.0	83.0	109.0	125.0	144.0	153.0	79.7
DK0005R	Keldsnor	54.0	63.0	72.0	82.0	89.0	98.0	107.3	99.5
DK0031R	Ulborg	51.0	64.0	78.0	89.0	97.0	111.0	121.0	98.9
DK0032R	Frederiksborg	36.0	50.0	64.0	76.0	82.0	90.0	96.0	90.4
DK0041R	Lille Valby	45.0	58.0	70.0	81.0	88.0	96.0	103.3	97.3
EE0009R	Lahemaa	48.0	68.0	86.0	99.0	107.0	115.0	119.2	99.7
EE0011R	Vilsandy	63.0	75.0	86.0	96.0	101.0	107.0	113.0	98.1
ES0007R	Víznar	76.9	92.0	107.0	123.0	131.0	141.0	148.0	98.0
ES0008R	Niembro	51.7	63.1	74.7	85.9	93.7	102.0	107.7	98.5
ES0009R	Campisabalos	78.9	96.3	114.0	137.0	148.0	164.0	174.6	96.6
ES0010R	Cabo de Creus	91.3	104.0	118.0	135.0	147.0	162.0	170.9	95.9
ES0011R	Barcarrola	48.4	65.2	81.8	96.3	105.0	115.0	121.0	97.3
ES0012R	Zarra	80.3	94.3	109.0	123.0	131.0	140.0	147.0	98.5
ES0013R	Palma de Mallorca	76.0	92.7	110.0	123.0	131.0	141.0	149.2	97.5
ES0014R	Els Torms	67.7	83.3	102.0	116.0	122.8	132.0	136.0	97.6
ES0015R	Risco Llamo	91.9	106.0	120.0	133.0	140.0	148.0	154.0	97.4
ES0016R	O Saviñao	56.6	73.0	91.0	105.0	116.0	130.0	140.0	95.1
FI0009R	Utö	65.0	76.0	86.0	95.0	101.0	108.0	112.0	96.1
FI0017R	Virolahti II	55.0	71.0	84.0	94.0	100.0	107.0	112.0	58.5
FI0022R	Oulanka	47.0	61.0	79.0	92.0	97.0	101.0	104.0	98.5
FI0037R	Ahtari II	50.0	65.0	80.0	91.0	95.0	100.0	105.0	98.7
FR0008A	Donon	69.0	87.0	107.0	134.0	149.0	164.0	170.0	97.6
FR0008B	Donon	71.0	89.0	109.0	136.0	150.0	166.0	172.0	97.6
FR0008C	Donon	71.0	92.0	114.0	139.8	154.0	167.0	174.0	85.0
FR0008D	Donon	73.0	91.0	111.0	138.0	153.0	167.0	174.0	99.0
FR0009R	Revin	51.0	69.0	88.0	110.0	125.0	147.0	160.0	96.7
FR0010R	Morvan	47.0	66.0	84.0	100.0	112.0	123.8	133.0	95.9
FR0012R	Iraty	79.0	94.0	106.0	120.0	130.0	144.0	154.0	89.3

Table 1.2, cont.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
FR0013R	Peyrusse Vieille	56.0	70.0	85.0	100.0	107.0	118.0	123.0	93.6
FR0014R	Montandon	44.0	59.0	77.0	98.0	112.0	127.0	138.0	92.4
GB0002R	Eskdalemuir	38.0	50.0	64.0	76.0	84.0	94.0	104.0	99.1
GB0006R	Lough Navar	32.0	48.0	64.0	80.0	88.0	98.0	110.0	98.1
GB0013R	Yarner Wood	48.0	62.0	78.0	92.0	100.0	114.0	135.2	96.6
GB0014R	High Muffles	48.0	62.0	76.0	92.0	102.0	118.0	126.0	85.1
GB0015R	Strath Vaich Dam	58.0	68.0	82.0	92.0	96.0	106.0	114.9	62.7
GB0031R	Aston Hill	52.0	64.0	78.0	90.0	98.0	110.0	126.0	96.6
GB0032R	Bottesford	34.0	54.0	72.0	88.0	100.0	118.0	136.0	99.2
GB0033R	Bush	46.0	56.0	70.0	82.8	88.0	96.0	102.0	98.0
GB0034R	Glazebury	22.0	44.0	62.0	76.0	84.0	98.0	112.0	95.7
GB0036R	Harwell	38.0	54.0	72.0	90.0	100.0	114.0	126.1	95.5
GB0037R	Ladybower Res.	38.0	48.0	56.0	68.0	76.0	93.6	109.6	33.2
GB0038R	Lullington Heath	48.0	64.0	82.0	96.2	112.0	130.0	146.0	97.0
GB0039R	Sibton	38.0	54.0	72.0	86.0	94.0	108.0	124.0	98.8
GB0043R	Narberth	52.0	64.0	78.0	88.0	96.0	108.0	120.0	94.8
GB0044R	Somerton	48.0	62.0	78.0	92.0	100.0	118.0	130.0	95.8
GB0045R	Wicken Fen	34.0	54.0	72.0	90.0	104.0	126.0	139.9	86.6
GR0002R	Finokalia	93.6	105.4	118.9	130.5	135.3	140.9	144.4	73.1
HU0002R	K-puszta	56.0	79.0	105.0	124.0	134.0	144.0	149.0	88.7
IE0031R	Mace Head	56.0	64.0	82.0	96.0	100.0	110.0	116.0	98.8
IT0001R	Montelibretti	32.0	66.0	106.0	137.0	154.0	176.0	189.0	92.6
IT0004R	Ispra	32.2	63.4	96.7	126.2	148.8	174.9	185.8	98.1
LT0015R	Preila	53.0	71.0	83.0	94.0	100.0	108.0	112.0	98.0
LV0010R	Rucava	32.0	42.0	53.0	63.0	70.0	79.0	87.0	63.0
MT0001R	Giordan lighthouse	102.0	114.0	126.6	138.8	144.5	152.0	155.8	92.3
NL0009R	Kollumerwaard	38.0	56.0	71.0	85.0	92.0	102.0	108.0	93.8
NL0010R	Vredepeel	29.0	50.0	72.0	91.0	112.0	138.0	155.0	94.9
NO0001R	Birkenes	40.0	58.0	76.0	90.0	96.0	102.0	106.0	99.7
NO0015R	Tustervatn	52.0	65.0	83.0	95.0	100.0	106.0	109.1	100.0
NO0039R	Kårvatn	30.0	54.0	76.0	96.0	103.0	109.0	113.0	99.0
NO0041R	Osen	40.0	60.0	80.0	94.0	100.0	104.0	108.0	98.5
NO0042G	Spitsbergen, Zeppelinfjell	51.0	63.0	74.0	89.0	95.0	99.0	100.0	98.8
NO0043R	Prestebakke	54.0	68.0	84.0	94.0	102.0	110.0	116.0	99.3
NO0045R	Jeløya	50.0	63.0	78.0	89.0	97.0	102.0	106.0	100.0
NO0048R	Voss	40.0	56.0	78.0	93.0	101.0	108.0	111.0	99.0
NO0052R	Sandve	58.0	69.0	82.0	94.0	100.0	107.0	110.2	99.7
NO0055R	Karasjok	46.0	60.0	80.0	92.0	96.0	98.0	102.0	100.0
NO0056R	Hurdal	42.0	57.0	77.0	90.0	97.0	104.0	109.0	98.4
PL0002R	Jarczew	42.0	62.0	83.0	102.0	113.0	123.0	130.0	99.7
PL0003R	Sniezka	70.0	88.0	104.0	120.0	129.0	136.3	142.0	99.8
PL0004R	Leba	57.0	74.0	89.0	100.0	107.0	116.0	124.1	100.0
PL0005R	Diabla Gora	48.0	66.0	82.0	96.0	104.0	116.0	122.0	99.0
PT0004R	Monte Velho	55.0	77.0	92.0	112.0	122.0	136.4	147.0	94.2
RU0016R	Shepeljovo	50.0	64.0	76.0	88.0	94.0	104.0	114.0	71.7
RU0018R	Danki	24.0	50.0	72.0	86.0	94.0	100.0	106.0	66.4
SE0002R	Rörvik	55.0	71.0	85.0	96.0	104.0	114.0	121.0	98.4
SE0011R	Vavihill	54.0	69.0	84.0	98.0	105.0	113.0	120.0	99.7
SE0012R	Aspvreten	51.0	68.0	83.0	92.0	98.0	104.0	111.0	86.7
SE0013R	Esrange	49.0	64.0	85.0	96.0	100.0	105.0	108.0	99.8
SE0032R	Norra-Kvill	62.0	73.0	85.0	95.0	103.0	110.0	117.0	93.8
SE0035R	Vindeln	41.0	59.0	79.0	91.0	97.0	101.0	108.0	99.6
SE0039R	Grimsö	38.0	56.0	72.0	84.0	90.0	96.0	101.2	93.0
SI0008R	Iskrba	24.0	73.0	107.0	129.0	140.0	152.0	158.0	91.6
SI0031R	Zarodnje	78.0	94.0	110.0	126.0	134.0	142.0	147.0	87.9
SI0032R	Krvavec	95.0	108.0	123.0	138.0	147.0	160.0	171.0	89.9
SI0033R	Kovk	73.0	91.0	110.0	127.0	136.0	150.0	160.0	85.3
SK0004R	Stará Lesná	38.0	65.0	95.0	114.0	124.0	134.0	141.0	96.2
SK0006R	Starina	48.0	66.0	86.0	101.0	111.0	119.0	127.0	99.4
SK0007R	Topolniky	30.0	45.0	66.0	86.0	100.0	117.2	123.0	67.0

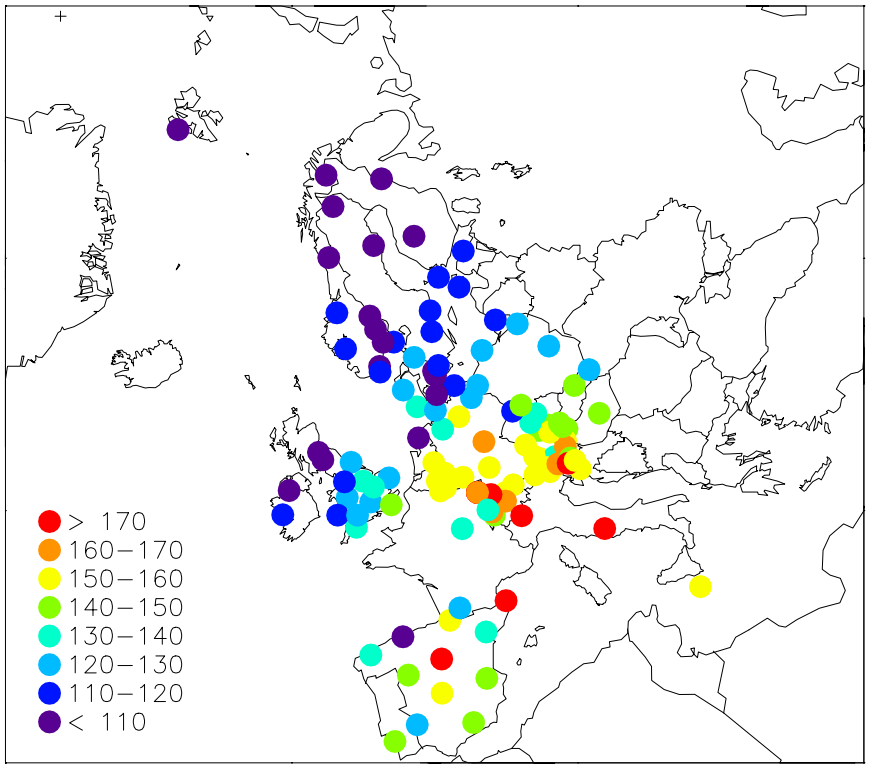


Figure 1.1: Ozone April–September 2001. 99-percentiles (µg/m^3).

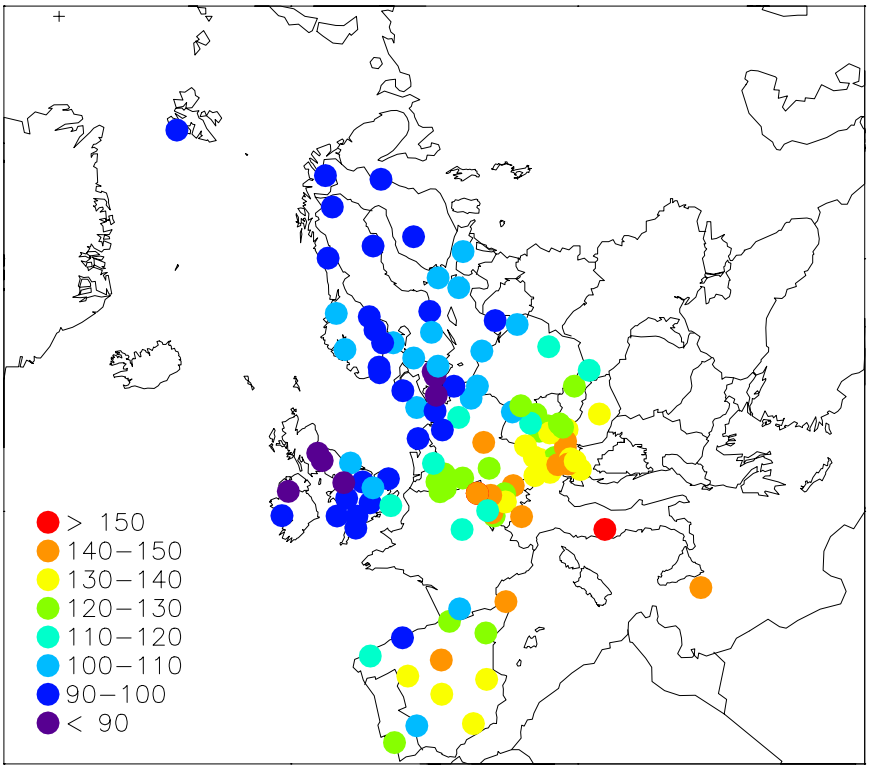


Figure 1.2: Ozone April–September 2001. 95-percentiles (µg/m^3).

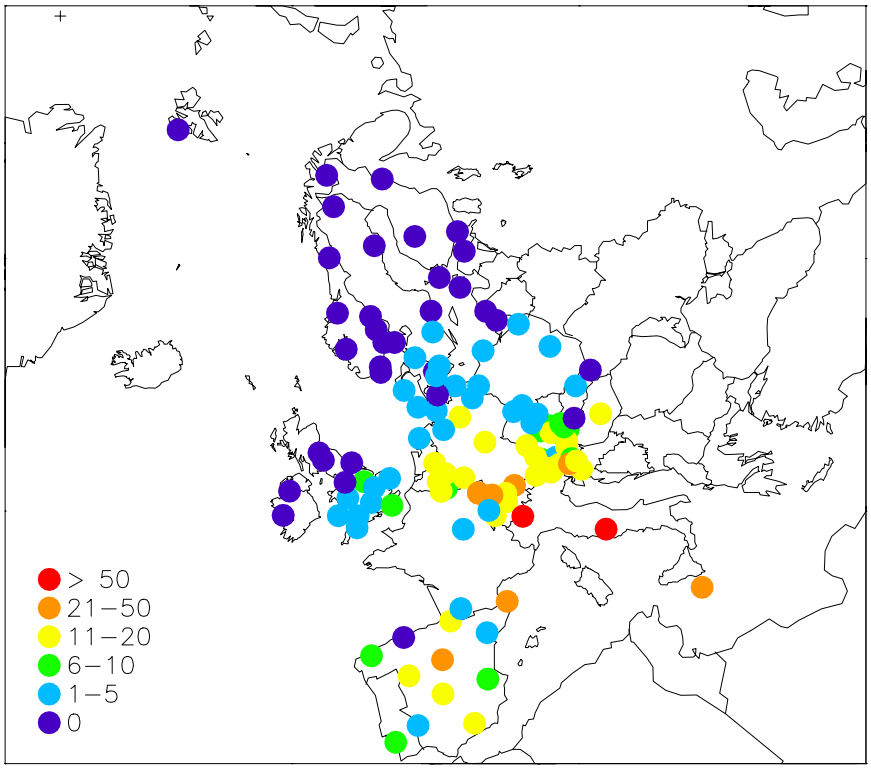


Figure 1.3: Number of exceedances of the threshold value of 150 µg/m^3. (Unit: number of days).

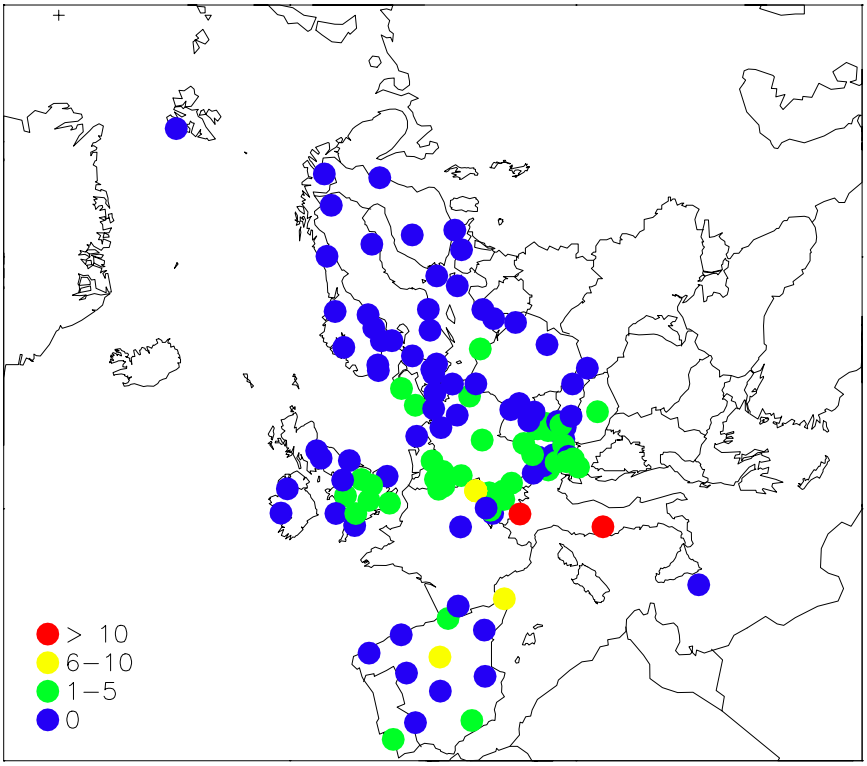


Figure 1.4: Number of exceedances of the threshold value of 180 µg/m^3. (Unit: number of days).

Annex 2

AOT40 and AOT60, figures and tables

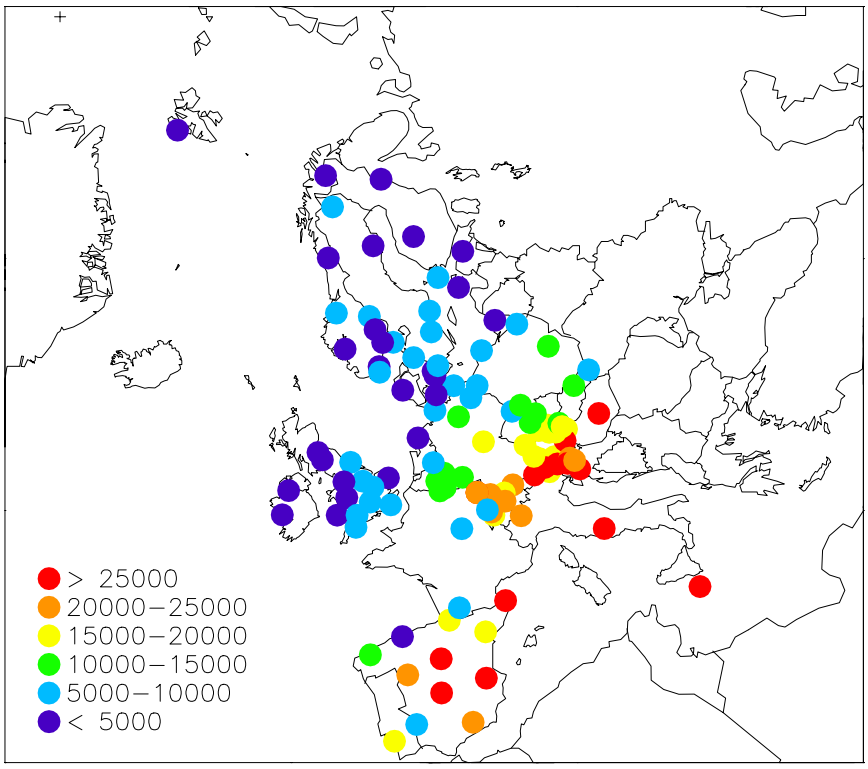


Figure 2.1: AOT40 (ppbh) April–September 2001 (daylight hours).

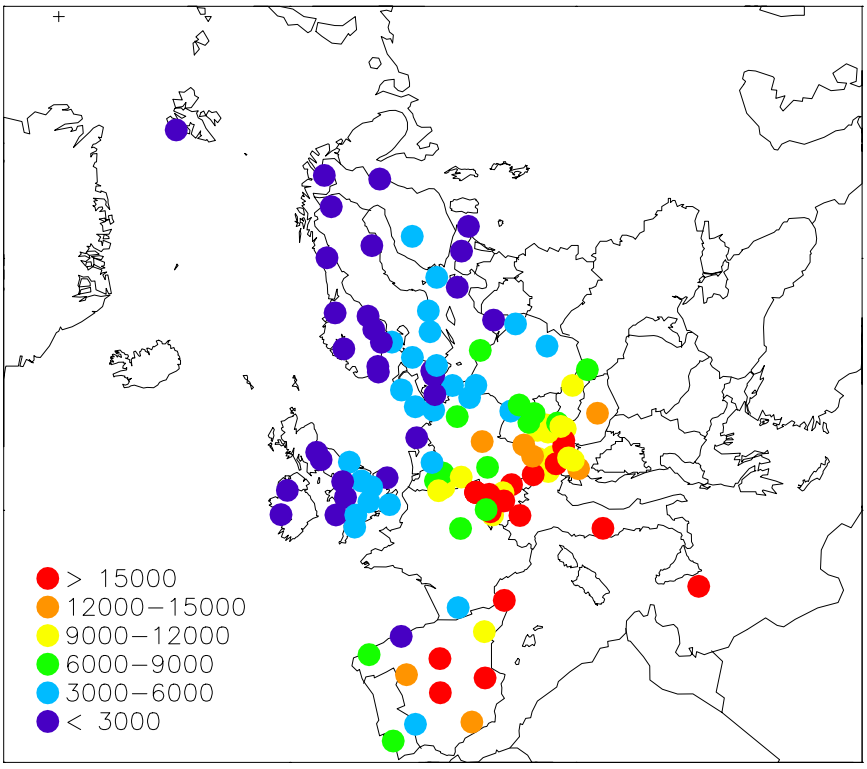


Figure 2.2: AOT40 (ppbh) May, June and July 2001 (daylight hours).

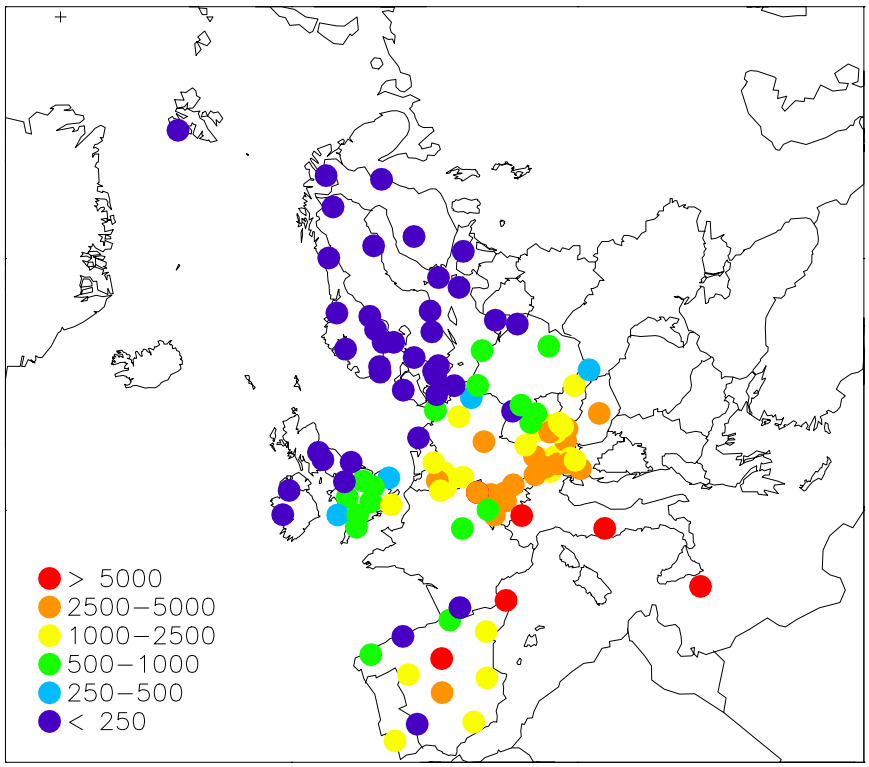


Figure 2.3: AOT60 (ppbh) April-September 2001 (daylight hours).

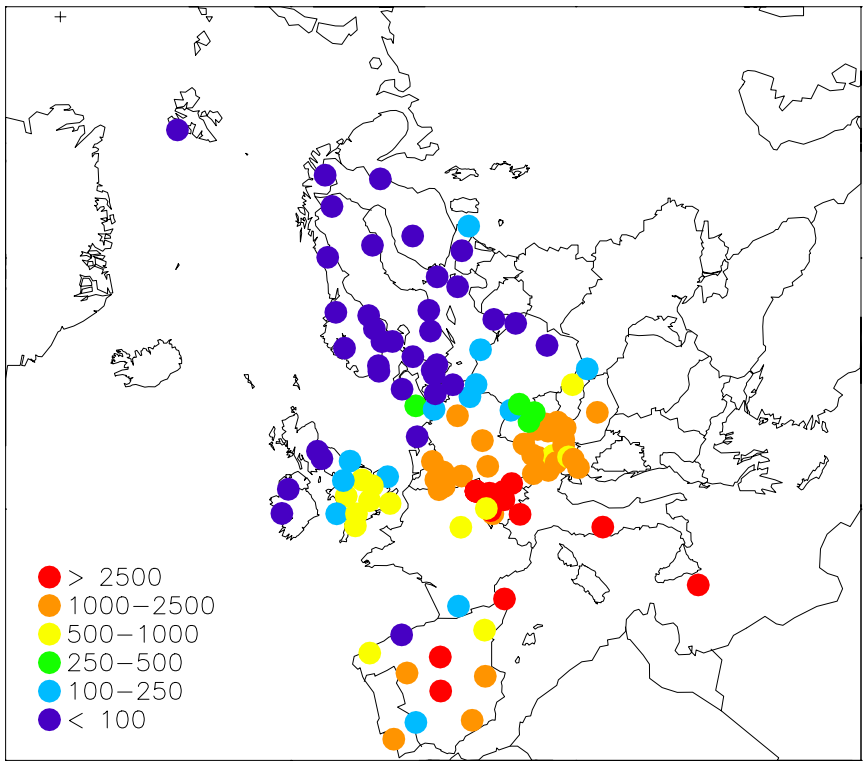


Figure 2.4: AOT60 (ppbh) May, June and July 2001 (daylight hours).

Table 2.1: AOT40 and AOT60 April–September 2001 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT0002R	Illmitz	17602	18362	2550	2660	96
AT0004R	St. Koloman	15547	16861	1537	1667	92
AT0005R	Vorhegg	16760	18045	1714	1846	93
AT0030R	Pillersdorf bei Retz	15177	16027	1959	2069	95
AT0032R	Sulzberg	24661	24727	3835	3845	100
AT0033R	Stolzalpe bei Murau	17452	18762	1136	1221	93
AT0034G	Sonnblick	31752	35858	3519	3974	89
AT0037R	Zillertaler Alpen	26829	28163	2708	2842	95
AT0038R	Gerlitzen	33627	34642	4213	4340	97
AT0040R	Masenberg	25792	27618	3452	3697	93
AT0041R	Haunsberg	19247	19264	3090	3093	100
AT0042R	Heidenreichstein	14868	15560	1893	1981	96
AT0043R	Forsthof	14820	15680	1588	1680	95
AT0044R	Graz Platte	22091	29411	4144	5517	75
AT0045R	Dunkelsteinerwald	17190	18042	3559	3735	95
AT0046R	Gänserndorf	14022	14621	2236	2331	96
AT0047R	Stixneusiedl	15203	15446	2110	2144	98
BE0001R	Offagne	11902	12824	1918	2066	93
BE0032R	Eupen	11576	12271	2357	2499	94
BE0035R	Vezin	11728	12285	2578	2700	95
CH0002R	Payerne	15907	16702	2685	2819	95
CH0003R	Tänikon	15973	16871	3163	3341	95
CH0004R	Chaumont	21502	22628	3630	3820	95
CH0005R	Rigi	20913	22741	3847	4184	92
CZ0001R	Svratouch	12471	12954	900	935	96
CZ0003R	Kosetice	11736	12124	870	899	97
DE0001R	Westerland	7762	9373	526	635	83
DE0002R	Langenbrügge	11781	12198	1952	2021	97
DE0003R	Schauinsland	22669	23490	4608	4774	97
DE0004R	Deuselbach	13468	14114	2239	2346	95
DE0005R	Brotjacklriegel	17280	18284	1987	2102	95
DE0007R	Neuglobsow	7340	7689	428	449	95
DE0008R	Schmücke	17094	18014	2897	3053	95
DE0009R	Zingst	5508	5737	160	166	96
DE0012R	Bassum	4158	5639	485	658	74
DE0026R	Ueckermünde	6776	7430	493	541	91
DE0035R	Lückendorf	4896	5306	170	184	92
DE0039R	Aukrug	4998	5414	498	539	92
DE0042R	Öhringen	10847	13143	1910	2315	83
DK0005R	Keldsnor	1842	1862	53	54	99
DK0031R	Ulborg	4368	4421	231	234	99
DK0032R	Frederiksborg	928	1031	0	0	90
DK0041R	Lille Valby	2082	2135	73	75	98
EE0009R	Lahemaa	4519	4540	6	6	100
EE0011R	Vilsandy	2852	2923	7	7	98
ES0007R	Víznar	22039	22663	2372	2439	97
ES0008R	Niembro	2480	2532	16	17	98
ES0009R	Campisabalos	34078	35447	7512	7813	96
ES0010R	Cabo de Creus	32096	33593	5583	5843	96
ES0011R	Barcarrola	7229	7551	161	168	96
ES0012R	Zarra	24892	25342	2382	2425	98
ES0013R	Palma de Mallorca	22524	23239	2088	2155	97
ES0014R	Els Torms	17987	18481	1043	1072	97
ES0015R	Risco Llamo	29496	30588	3283	3405	96
ES0016R	O Saviñao	11392	12071	904	958	94
FI0009R	Utö	5653	5919	5	5	95
FI0017R	Virolahti II	4001	6428	5	8	62
FI0022R	Oulanka	3662	3734	0	0	98
FI0037R	Ahtari II	4348	4438	0	0	98
FR0008A	Donon	21023	21286	4348	4402	99
FR0008B	Donon	23020	23319	5011	5076	99
FR0008C	Donon	22046	25678	5029	5858	86
FR0008D	Donon	24486	24782	5583	5650	99
FR0009R	Revin	12872	13442	2318	2421	96
FR0010R	Morvan	8670	9085	568	595	95
FR0012R	Iraty	13992	15703	594	667	89

Table 2.1, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
FR0013R	Peyrusse Vieille	6764	7208	188	200	94
FR0014R	Montandon	7898	8482	860	924	93
GB0002R	Eskdalemuir	1676	1694	37	37	99
GB0006R	Lough Navar	2313	2364	85	87	98
GB0013R	Yarner Wood	5568	5766	564	584	97
GB0014R	High Muffles	4424	5128	204	236	86
GB0015R	Strath Vaich Dam	3059	5228	26	44	59
GB0031R	Aston Hill	4047	4193	562	582	97
GB0032R	Bottesford	5699	5783	838	850	99
GB0033R	Bush	1714	1755	43	44	98
GB0034R	Glazebury	1927	2028	115	121	95
GB0036R	Harwell	5550	5870	746	789	95
GB0037R	Ladybower Res.	532	1704	75	240	31
GB0038R	Lullington Heath	7322	7620	1089	1133	96
GB0039R	Sibton	4130	4199	329	334	98
GB0043R	Narberth	3699	3841	253	263	96
GB0044R	Somerton	5805	6112	685	721	95
GB0045R	Wicken Fen	5734	6585	864	992	87
GR0002R	Finokalia	20846	29100	1879	2624	72
HU0002R	K-puszta	22354	25012	3173	3550	89
IE0031R	Mace Head	4481	4542	55	56	99
IT0001R	Montelibretti	27564	29866	8791	9525	92
IT0004R	Ispra	23400	23979	7513	7698	98
LT0015R	Preila	3660	3721	30	31	98
LV0010R	Rucava	208	347	0	0	60
MT0001R	Giordan lighthouse	37424	40608	5749	6238	92
NL0009R	Kollumerwaard	2944	3100	212	223	95
NL0010R	Vredepeel	7770	8071	1749	1817	96
NO0001R	Birkenes	4049	4070	2	2	99
NO0015R	Tustervatn	4598	4602	0	0	100
NO0039R	Kårvatn	5661	5714	18	18	99
NO0041R	Osen	5126	5213	0	0	98
NO0042G	Spitsbergen, Zeppelinfjell	2388	2425	0	0	98
NO0043R	Prestebakke	6674	6729	37	37	99
NO0045R	Jeløya	3544	3548	0	0	100
NO0048R	Voss	4704	4753	0	0	99
NO0052R	Sandve	5148	5172	14	15	100
NO0055R	Karasjok	3231	3234	0	0	100
NO0056R	Hurdal	4122	4197	14	15	98
PL0002R	Jarczew	10396	10405	616	616	100
PL0003R	Sniezka	13520	13532	659	660	100
PL0004R	Leba	9726	9726	723	723	100
PL0005R	Diabla Gora	6998	7047	190	192	99
PT0004R	Monte Velho	15816	16694	1946	2054	95
RU0016R	Shepeljovo	2723	3652	111	149	75
RU0018R	Danki	2325	3405	20	29	68
SE0002R	Rörvik	7516	7635	218	221	98
SE0011R	Vavihill	7892	7927	236	237	100
SE0012R	Aspvreten	4344	5042	8	10	86
SE0013R	Esrange	5268	5281	2	2	100
SE0032R	Norra-Kvill	6380	6799	146	156	94
SE0035R	Vindeln	4330	4346	6	6	100
SE0039R	Grimsö	1981	2126	0	0	93
SI0008R	Iskrba	23996	26063	4166	4525	92
SI0031R	Zarodnje	18442	20118	1820	1986	92
SI0032R	Krvavec	28416	31590	3867	4299	90
SI0033R	Kovk	18800	20460	2114	2300	92
SK0004R	Stará Lesná	13398	13929	1138	1183	96
SK0006R	Starina	9582	9603	300	301	100
SK0007R	Topolniky	3372	5156	182	278	65

Table 2.2: AOT40 and AOT60 May–July 2001 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT0002R	Illmitz	10456	10791	1256	1296	97
AT0004R	St. Koloman	10048	11056	988	1087	91
AT0005R	Vorhegg	10543	11350	992	1068	93
AT0030R	Pillersdorf bei Retz	9504	10023	989	1043	95
AT0032R	Sulzberg	16129	16129	2848	2848	100
AT0033R	Stolzalpe bei Murau	10916	11836	497	539	92
AT0034G	Sonnblick	17968	21951	2005	2450	82
AT0037R	Zillertaler Alpen	16091	16883	1432	1502	95
AT0038R	Gerlitzen	19858	20510	2240	2314	97
AT0040R	Masenberg	15019	16183	1561	1682	93
AT0041R	Haunsberg	12939	12961	2150	2153	100
AT0042R	Heidenreichstein	9448	9851	1054	1099	96
AT0043R	Forsthof	9640	10184	875	924	95
AT0044R	Graz Platte	14220	16029	2104	2371	89
AT0045R	Dunkelsteinerwald	10935	11523	1988	2094	95
AT0046R	Gänserndorf	8588	8956	1139	1188	96
AT0047R	Stixneusiedl	9502	9582	1132	1142	99
BE0001R	Offagne	9066	9323	1689	1737	97
BE0032R	Eupen	8306	8511	1754	1797	98
BE0035R	Vezin	8320	8527	2064	2115	98
CH0002R	Payerne	10736	11253	2007	2104	95
CH0003R	Tänikon	11176	11874	2390	2539	94
CH0004R	Chaumont	14253	15004	2640	2779	95
CH0005R	Rigi	14007	15352	2875	3151	91
CZ0001R	Svratouch	7653	7757	422	428	99
CZ0003R	Kosetice	7134	7477	400	420	95
DE0001R	Westerland	5406	5636	315	328	96
DE0002R	Langenbrügge	7656	8087	1077	1138	95
DE0003R	Schauinsland	15518	16040	3577	3697	97
DE0004R	Deuselbach	9837	10232	1706	1774	96
DE0005R	Brotjacklriegel	11567	12243	1423	1506	94
DE0007R	Neuglobsow	5472	5740	232	243	95
DE0008R	Schmücke	11952	12472	1888	1970	96
DE0009R	Zingst	3984	4123	44	46	97
DE0012R	Bassum	2244	3267	182	266	69
DE0026R	Ueckermünde	4836	5447	200	225	89
DE0035R	Lückendorf	3176	3304	124	129	96
DE0039R	Aukrug	3206	3369	187	196	95
DE0042R	Öhringen	7406	7750	1259	1317	96
DK0005R	Keldsnor	1030	1041	0	0	99
DK0031R	Ulborg	3266	3279	92	92	100
DK0032R	Frederiksborg	688	695	0	0	99
DK0041R	Lille Valby	1091	1099	0	0	99
EE0009R	Lahemaa	2943	2952	2	2	100
EE0011R	Vilsandy	2236	2303	6	6	97
ES0007R	Víznar	14415	14801	2194	2252	97
ES0008R	Niembro	1688	1726	16	17	98
ES0009R	Campisabalos	21164	21852	5776	5964	97
ES0010R	Cabo de Creus	19696	20977	4244	4520	94
ES0011R	Barcarrola	4209	4511	151	162	93
ES0012R	Zarra	16067	16399	2003	2044	98
ES0013R	Palma de Mallorca	13612	14054	1582	1633	97
ES0014R	Els Torms	11124	11452	744	766	97
ES0015R	Risco Llamo	17347	18101	2454	2561	96
ES0016R	O Saviñao	6888	7265	700	738	95
FI0009R	Utö	4180	4245	2	3	98
FI0017R	Virolahti II	3086	3663	5	6	84
FI0022R	Oulanka	1984	2031	0	0	98
FI0037R	Ahtari II	2998	3042	0	0	99
FR0008A	Donon	14836	15007	3350	3389	99
FR0008B	Donon	16170	16383	3849	3900	99
FR0008C	Donon	16190	16389	3858	3906	99
FR0008D	Donon	17021	17216	4277	4326	99
FR0009R	Revin	9598	10274	2032	2175	93
FR0010R	Morvan	6450	6734	519	542	96
FR0012R	Iraty	7748	9185	530	628	84

Table 2.2, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
FR0013R	Peyrusse Vieille	4816	4844	118	118	99
FR0014R	Montandon	6120	6312	788	813	97
GB0002R	Eskdalemuir	1524	1552	37	38	98
GB0006R	Lough Navar	1606	1667	85	88	96
GB0013R	Yarner Wood	3890	3928	564	570	99
GB0014R	High Muffles	3881	3916	203	205	99
GB0015R	Strath Vaich Dam	1576	4925	26	81	32
GB0031R	Aston Hill	2810	2945	562	589	95
GB0032R	Bottesford	4212	4275	743	754	99
GB0033R	Bush	1041	1054	43	44	99
GB0034R	Glazebury	1564	1700	115	125	92
GB0036R	Harwell	3921	4297	709	777	91
GB0037R	Ladybower Res.	482	2482	75	386	19
GB0038R	Lullington Heath	5357	5523	958	988	97
GB0039R	Sibton	2806	2874	149	153	98
GB0043R	Narberth	2812	2895	242	249	97
GB0044R	Somerton	4216	4530	671	721	93
GB0045R	Wicken Fen	4485	4861	793	860	92
GR0002R	Finokalia	11775	15098	1107	1420	78
HU0002R	K-puszta	13574	14764	1854	2016	92
IE0031R	Mace Head	2448	2500	55	56	98
IT0001R	Montelibretti	17732	18176	5954	6103	98
IT0004R	Ispra	16648	16971	6019	6136	98
LT0015R	Preila	2516	2516	11	11	100
LV0010R	Rucava	0	0	0	0	40
MT0001R	Giordan lighthouse	21093	22977	3627	3951	92
NL0009R	Kollumerwaard	1630	1653	6	6	99
NL0010R	Vredepeel	5498	5542	1078	1087	99
NO0001R	Birkenes	2383	2392	2	2	100
NO0015R	Tustervatn	1630	1632	0	0	100
NO0039R	Kårvatn	2032	2062	6	6	99
NO0041R	Osen	2650	2675	0	0	99
NO0042G	Spitsbergen, Zeppelinfjell	1008	1022	0	0	99
NO0043R	Prestebakke	5060	5135	21	21	99
NO0045R	Jeløya	2201	2201	0	0	100
NO0048R	Voss	2318	2326	0	0	100
NO0052R	Sandve	2384	2395	0	0	100
NO0055R	Karasjok	1531	1533	0	0	100
NO0056R	Hurdal	2832	2845	14	15	100
PL0002R	Jarczew	5750	5755	90	90	100
PL0003R	Sniezka	7998	8011	290	290	100
PL0004R	Leba	6248	6248	102	102	100
PL0005R	Diabla Gora	4725	4759	60	61	99
PT0004R	Monte Velho	6932	7409	1043	1115	94
RU0016R	Shepeljovo	2489	2655	103	110	94
RU0018R	Danki	1441	2153	12	18	67
SE0002R	Rörvik	4726	4755	66	67	99
SE0011R	Vavihill	5631	5658	86	87	100
SE0012R	Aspvreten	3320	3777	4	4	88
SE0013R	Esrange	2796	2808	0	0	100
SE0032R	Norra-Kvill	3718	4151	27	30	90
SE0035R	Vindeln	2618	2630	6	6	100
SE0039R	Grimsö	1378	1400	0	0	98
SI0008R	Iskrba	13549	14265	2169	2284	95
SI0031R	Zarodnje	10339	11272	644	703	92
SI0032R	Krvavec	14670	17812	1626	1975	82
SI0033R	Kovk	11057	11610	1028	1079	95
SK0004R	Stará Lesná	9834	10295	699	732	96
SK0006R	Starina	6008	6027	122	122	100
SK0007R	Topolniky	2200	4521	127	261	49

Annex 3

Seasonal variation

Table 3.1: Monthly mean concentrations 2001 (μg/m³).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT0002R	Illmitz	32.5	51.9	61.9	78.2	86.7	80.6	81.0	84.7	55.7	40.0	35.7	36.3
AT0004R	St. Koloman	70.4	70.7	78.4	91.4	96.9	99.5	96.1	95.7	68.1	66.7	51.2	62.0
AT0005R	Vorhegg	52.2	70.4	74.9	93.4	91.1	101.0	88.4	88.1	64.8	53.4	50.9	55.1
AT0030R	Pillersdorf bei Retz	35.6	53.1	59.5	77.3	87.3	85.6	83.2	85.5	54.4	40.4	37.9	45.1
AT0032R	Sulzberg	70.6	70.7	85.3	98.1	102.7	105.4	105.9	102.9	73.4	73.8	54.3	56.2
AT0033R	Stolzalpe bei Murau	60.2	74.9	74.6	88.6	86.6	94.3	86.8	84.5	62.5	48.1	57.3	65.3
AT0034G	Sonnblick	92.9	93.5	108.4	115.5	118.3	119.4	115.9	115.5	93.7	93.9	83.6	82.9
AT0037R	Zillertaler Alpen	85.9	83.6	105.5	111.6	113.1	110.9	106.8	107.6	86.3	89.7	79.5	79.6
AT0038R	Gerlitzen	76.9	82.0	97.5	110.3	113.8	120.5	114.2	119.1	93.4	88.9	84.5	87.2
AT0040R	Masenberg	58.5	75.0	78.1	100.0	108.2	108.0	102.6	115.3	76.5	71.8	60.3	67.4
AT0041R	Haunsberg	49.4	60.7	70.5	86.1	96.0	95.4	97.7	93.7	63.3	58.1	44.2	49.2
AT0042R	Heidenreichstein	35.6	49.1	61.8	72.3	80.7	80.9	76.1	76.2	53.2	46.6	40.2	46.5
AT0043R	Forsthof	36.5	50.1	61.5	79.3	88.5	95.1	87.6	94.2	57.7	48.7	40.0	44.9
AT0044R	Graz Platte	38.9	64.8	66.6	-	105.6	105.3	102.8	114.7	78.6	44.3	41.1	36.0
AT0045R	Dunkelsteinerwald	25.1	45.1	54.6	68.3	76.5	84.1	82.0	84.1	51.5	34.5	37.1	40.4
AT0046R	Gänserndorf	27.2	41.6	49.6	62.7	74.5	69.7	75.4	80.3	50.2	35.3	34.3	35.2
AT0047R	Stixneusiedl	29.3	45.8	58.2	68.1	81.8	83.7	78.1	86.5	54.9	39.5	36.0	37.7
BE0001R	Offagne	44.9	48.9	54.1	72.3	76.2	74.8	76.2	66.8	45.3	44.9	34.5	41.1
BE0032R	Eupen	41.3	42.4	53.8	70.4	68.9	74.4	72.5	70.1	44.4	54.3	30.4	34.1
BE0035R	Vezin	32.8	37.8	47.3	69.3	64.2	65.9	63.7	55.6	35.8	39.2	20.8	23.0
CH0002R	Payerne	31.1	38.9	58.3	72.1	73.2	76.8	76.0	72.1	49.6	34.3	30.0	36.1
CH0003R	Tänikon	26.1	41.9	58.9	73.3	74.4	79.0	77.7	70.9	48.2	30.7	31.7	41.1
CH0004R	Chaumont	64.6	66.7	81.2	91.6	98.5	101.8	103.7	103.3	72.1	74.6	58.5	55.9
CH0005R	Rigi	67.8	65.1	81.0	92.1	96.3	102.4	102.8	99.7	70.7	74.0	51.0	51.2
CZ0001R	Svratouch	46.7	60.5	65.1	83.5	88.5	83.8	78.6	86.2	53.4	53.6	43.5	47.6
CZ0003R	Kosetice	43.6	56.7	64.0	77.1	78.8	78.0	72.9	73.9	47.6	44.1	40.3	43.4
DE0001R	Westerland	34.5	53.0	65.4	76.1	86.0	81.0	78.7	70.1	-	47.8	56.1	46.2
DE0002R	Langenbrügge	29.8	48.0	58.5	67.9	79.2	66.5	68.3	67.3	41.6	31.7	31.6	33.9
DE0003R	Schauinsland	72.7	68.2	82.2	91.0	102.4	102.1	104.1	103.0	73.1	80.4	64.6	65.6
DE0004R	Deuselbach	45.0	53.2	62.7	75.7	84.1	83.7	84.5	80.2	51.5	50.0	35.3	40.2
DE0005R	Brotjacklriegel	68.2	64.7	79.8	91.5	105.5	94.9	94.7	96.7	61.4	65.5	44.9	55.5
DE0007R	Neuglobsow	22.8	44.1	50.9	56.0	73.4	62.0	64.7	55.2	36.4	29.4	41.8	43.8
DE0008R	Schmücke	52.0	58.0	63.1	82.0	93.6	90.9	98.2	97.3	59.0	60.0	48.1	46.6
DE0009R	Zingst	32.4	54.6	70.8	70.3	76.6	72.0	72.4	61.5	47.3	41.1	49.9	43.6
DE0012R	Bassum	-	57.6	48.0	56.7	58.1	57.2	-	65.4	33.7	27.6	24.7	29.2
DE0017R	Ansbach	23.6	-	-	-	-	-	-	-	-	-	-	-

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DE0026R	Ueckermünde	28.4	47.8	61.6	65.0	75.7	70.4	74.6	61.5	44.1	37.1	39.5	36.9
DE0035R	Lückendorf	37.8	51.8	54.0	62.1	68.0	66.2	72.8	67.3	40.8	38.4	33.1	36.0
DE0039R	Aukrug	22.5	36.8	47.9	56.6	62.4	62.5	62.3	55.7	35.6	31.1	35.1	26.3
DE0042R	Öhringen	-	-	-	58.5	70.5	60.0	65.3	67.4	-	-	-	-
DK0005R	Keldsnor	33.5	50.7	62.9	63.3	68.3	66.3	62.4	64.6	54.0	43.6	52.5	39.6
DK0031R	Ulborg	37.1	57.4	63.6	61.6	77.3	72.0	68.6	62.6	46.1	48.5	56.5	40.0
DK0032R	Frederiksborg	29.8	46.0	56.0	47.0	51.7	58.4	53.3	-	38.0	35.7	45.5	32.1
DK0041R	Lille Valby	29.1	42.2	53.1	58.9	60.3	57.0	60.2	58.0	44.7	40.9	46.6	34.8
EE0009R	Lahemaa	52.9	63.7	78.8	83.6	79.7	62.0	69.0	52.1	50.9	46.7	51.1	54.1
EE0011R	Vilsandy	48.8	62.1	76.0	74.9	81.9	77.4	81.9	69.8	60.9	57.4	56.4	53.9
ES0007R	Víznar	62.7	67.9	70.9	87.8	95.9	106.3	94.3	87.6	81.1	62.8	58.7	63.1
ES0008R	Niembro	57.1	58.5	61.6	71.1	76.1	64.3	52.6	55.9	62.1	52.5	49.6	42.4
ES0009R	Campisabalos	75.2	74.3	87.5	93.2	100.8	105.6	105.4	100.2	85.2	70.4	67.6	58.0
ES0010R	Cabo de Creus	76.9	85.3	91.5	105.6	114.7	108.3	112.5	102.5	94.8	89.4	70.7	67.1
ES0011R	Barcarrola	50.8	50.8	56.3	61.3	62.0	67.0	65.0	61.6	71.5	49.9	46.5	46.0
ES0012R	Zarra	62.5	67.9	74.5	86.1	100.7	106.7	97.9	94.6	84.1	70.2	58.0	61.4
ES0013R	Palma de Mallorca	74.8	73.9	80.4	90.6	100.8	101.6	89.4	90.3	85.3	70.4	61.1	60.4
ES0014R	Els Torms	37.2	42.2	52.3	75.0	82.3	86.9	86.8	92.1	80.4	67.8	52.8	44.6
ES0015R	Risco Llamo	78.0	77.9	83.3	98.0	110.3	115.0	107.3	98.5	106.7	76.3	69.5	76.7
ES0016R	O Saviñao	-	-	77.7	81.9	87.1	80.0	64.5	67.1	66.4	61.5	54.5	40.9
FI0009R	Utö	54.8	63.9	75.9	77.6	81.6	73.1	83.2	73.1	65.6	-	-	61.2
FI0017R	Virolahti II	43.5	54.8	69.1	71.5	69.5	62.0	70.4	-	-	44.5	48.3	58.7
FI0022R	Oulanka	55.3	68.7	80.1	84.9	74.1	67.8	55.3	46.4	47.9	48.6	58.1	62.7
FI0037R	Ahtari II	45.6	61.6	74.2	76.7	75.3	68.5	64.8	50.5	49.9	42.6	53.0	54.6
FR0008A	Donon	55.5	57.6	69.3	85.1	97.9	97.7	99.7	98.0	66.6	68.4	42.5	45.1
FR0008B	Donon	56.4	58.7	70.3	86.3	100.0	100.0	101.5	99.8	68.4	70.0	43.5	45.4
FR0008C	Donon	57.0	59.2	71.1	-	100.9	100.7	102.2	100.8	67.9	70.7	44.2	46.0
FR0008D	Donon	57.8	59.3	71.5	88.2	102.4	101.9	104.0	102.3	70.6	72.0	44.7	46.6
FR0009R	Revin	42.0	47.5	58.9	76.8	77.4	85.5	78.3	71.1	46.7	46.3	33.6	36.8
FR0010R	Morvan	50.8	50.0	67.3	73.6	73.3	70.7	69.0	64.9	43.9	54.8	34.4	39.0
FR0012R	Iraty	76.8	77.0	86.3	95.7	106.9	101.6	84.4	92.4	85.6	80.6	76.4	78.2
FR0013R	Peyrusse Vieille	50.5	52.7	66.1	73.5	78.9	75.8	64.6	67.9	61.6	56.6	40.7	39.5
FR0014R	Montandon	37.0	34.8	-	55.4	60.2	72.1	72.4	68.0	42.6	46.9	34.8	41.6
GB0002R	Eskdalemuir	37.2	43.1	54.4	60.8	64.0	52.1	45.4	35.6	44.0	43.6	40.8	36.5
GB0006R	Lough Navar	39.2	44.5	54.1	63.9	62.7	50.3	38.9	30.3	39.7	46.3	41.6	36.9

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB0013R	Yarner Wood	49.0	55.9	69.1	79.2	74.7	68.6	56.4	49.5	52.4	56.8	48.2	42.3
GB0014R	High Muffles	43.8	-	-	-	79.4	66.8	61.3	50.4	52.6	43.0	45.0	46.4
GB0015R	Strath Vaich Dam	51.6	67.1	73.4	81.0	77.6	-	-	55.3	61.9	-	-	-
GB0031R	Aston Hill	48.7	59.5	61.7	81.4	70.4	70.1	65.1	57.0	54.5	60.5	-	-
GB0032R	Bottesford	31.3	35.8	51.9	68.8	61.6	61.1	54.6	41.1	38.6	44.0	27.6	28.5
GB0033R	Bush	41.7	51.1	60.7	74.2	70.6	59.4	50.2	45.7	47.3	50.7	55.3	43.2
GB0034R	Glazebury	20.9	28.8	36.7	55.2	48.0	46.0	44.0	30.3	36.7	34.8	26.0	22.9
GB0036R	Harwell	36.9	41.2	55.2	71.9	59.4	68.0	59.9	47.2	36.5	45.1	39.4	33.4
GB0037R	Ladybower Res.	40.7	44.8	-	-	-	-	56.7	-	45.1	46.2	44.3	38.7
GB0038R	Lullington Heath	41.6	45.4	59.0	75.5	74.6	73.0	67.6	61.0	47.4	59.8	39.5	35.7
GB0039R	Sibton	29.5	40.3	53.1	67.0	65.6	59.3	54.1	49.1	41.3	37.7	32.5	36.0
GB0043R	Narberth	55.4	62.3	69.1	77.5	75.7	69.8	59.3	52.3	55.8	61.5	55.9	48.2
GB0044R	Somerton	42.9	48.6	64.2	74.8	67.1	72.7	58.5	52.6	55.5	55.4	33.4	36.1
GB0045R	Wicken Fen	27.9	33.3	51.2	63.9	59.7	60.1	56.3	43.4	40.1	32.4	25.8	27.4
GR0002R	Finokalia	76.5	80.4	-	-	100.4	106.7	110.7	118.1	92.1	97.3	77.0	69.1
HU0002R	K-puszta	32.4	60.1	67.6	80.2	92.7	87.2	75.6	81.5	55.7	51.5	38.5	39.1
IE0031R	Mace Head	59.0	68.8	71.4	89.9	85.0	65.5	55.0	57.3	58.5	68.7	72.2	56.5
IT0001R	Montelibretti	26.9	39.6	51.3	61.6	59.0	80.2	94.7	81.6	52.8	43.1	25.8	30.2
IT0004R	Ispra	20.2	33.5	43.7	70.9	76.7	81.1	78.6	64.4	34.0	18.7	16.2	22.2
LT0015R	Preila	42.3	51.4	68.6	71.3	72.8	76.3	71.5	67.8	45.1	47.5	51.4	43.5
LV0010R	Rucava	36.7	40.9	49.0	41.0	44.4	-	-	50.8	35.6	36.9	47.2	40.9
MT0001R	Giordan lighthouse	91.5	101.1	104.2	121.2	121.3	119.7	110.0	110.7	102.8	94.6	89.5	88.2
NL0009R	Kollumerwaard	23.0	41.8	48.6	63.2	66.0	59.9	50.9	49.1	40.2	25.9	38.6	38.0
NL0010R	Vredepeel	21.3	33.9	34.0	59.8	62.2	58.4	54.9	48.1	29.9	23.2	15.6	25.6
NO0001R	Birkenes	44.2	64.9	64.6	72.1	72.0	60.5	49.8	44.1	41.7	45.7	54.2	33.5
NO0015R	Tustervatn	67.3	74.8	86.7	95.0	81.6	66.6	50.9	49.3	54.6	55.4	73.5	68.9
NO0039R	Kårvatn	63.6	74.1	87.0	89.3	68.5	55.6	39.5	34.6	35.9	36.5	67.6	55.8
NO0041R	Osen	50.5	62.8	73.5	84.7	71.5	64.9	52.2	40.7	37.5	37.6	53.5	47.7
NO0042G	Spitsbergen, Zeppelinfjell	73.6	81.9	83.7	82.7	66.5	59.5	49.2	55.7	66.6	73.1	65.9	74.3
NO0043R	Prestebakke	42.8	65.2	69.1	76.5	78.5	73.7	68.4	60.7	49.9	53.3	60.8	40.0
NO0045R	Jeløya	31.8	58.1	62.5	76.8	74.6	68.1	63.9	52.6	45.4	41.0	53.3	33.0
NO0048R	Voss	57.7	67.1	82.2	87.3	73.6	62.0	46.8	40.1	41.4	46.4	56.3	48.1
NO0052R	Sandve	51.5	66.5	75.2	84.3	77.1	71.0	66.4	61.6	55.3	60.6	65.9	46.1

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NO0055R	Karasjok	62.9	74.6	83.1	88.8	75.6	67.4	48.9	46.3	47.8	56.4	63.2	66.6
NO0056R	Hurdal	43.7	58.2	64.1	74.7	73.6	64.5	55.4	41.5	37.9	33.5	51.9	46.8
PL0002R	Jarczew	32.8	50.9	67.0	71.5	76.3	61.9	61.3	63.4	48.1	35.4	36.9	40.6
PL0003R	Sniezka	72.2	75.1	85.0	95.7	97.7	92.0	81.1	90.6	63.9	71.6	60.1	58.4
PL0004R	Leba	41.6	60.2	76.2	78.3	82.8	77.1	76.4	68.0	52.6	47.9	55.2	50.9
PL0005R	Diabla Gora	48.4	58.5	74.6	73.5	78.0	67.7	67.2	54.0	45.0	43.3	48.4	48.1
PT0004R	Monte Velho	60.7	64.3	73.5	80.7	81.0	72.0	62.9	82.1	65.1	50.1	50.5	50.9
RU0016R	Shepeljovo	39.6	48.7	62.3	60.8	69.9	62.2	73.4	-	45.1	-	43.2	42.5
RU0018R	Danki	-	58.3	66.7	63.2	-	53.2	42.5	32.0	-	-	-	-
SE0002R	Rörvik	41.3	49.7	65.0	79.4	74.8	77.0	69.9	64.5	46.5	42.8	54.7	36.4
SE0011R	Vavihill	41.6	56.0	69.1	75.9	81.5	72.5	75.9	63.5	45.4	44.5	54.3	41.8
SE0012R	Aspvreten	43.4	59.8	67.1	70.3	75.8	70.8	67.3	59.0	48.6	46.5	56.2	45.5
SE0013R	Esrange	63.2	73.9	85.2	91.7	80.3	69.7	55.2	48.1	53.3	50.6	61.6	66.1
SE0032R	Norra-Kvill	48.5	68.7	81.5	82.2	82.1	73.6	75.7	70.2	56.9	57.8	55.1	44.6
SE0035R	Vindeln	48.6	64.7	75.2	78.3	70.3	67.8	52.8	40.5	39.7	27.7	51.3	51.9
SE0039R	Grimsö	41.3	64.9	66.2	69.2	64.1	61.1	55.7	44.4	38.0	35.3	49.8	42.0
SI0008R	Iskrba	51.7	56.4	77.5	76.1	75.6	75.1	64.2	72.0	55.3	40.2	34.8	47.9
SI0031R	Zarodnje	45.6	61.9	78.9	95.0	96.9	98.7	94.0	104.3	75.4	57.9	48.4	42.9
SI0032R	Krvavec	75.6	81.7	96.1	108.5	108.9	116.2	113.4	123.2	89.9	86.2	73.5	73.7
SI0033R	Kovk	41.4	59.4	68.8	86.8	96.0	97.1	90.6	106.8	67.8	60.5	38.6	43.4
SK0004R	Stará Lesná	43.9	61.8	67.6	80.6	91.5	77.0	68.2	46.1	33.1	26.5	30.5	33.5
SK0006R	Starina	58.9	68.5	75.6	73.5	79.3	74.7	61.0	63.7	50.8	43.9	48.9	52.2
SK0007R	Topolniky	21.0	33.4	26.1	30.3	53.9	71.2	-	56.8	36.1	27.3	26.7	25.5

Table 3.2: Monthly data capture 2001 (μg/m³).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT0002R	Illmitz	95.6	92.1	96.0	96.7	97.0	99.4	97.6	95.6	96.3	96.0	96.0	95.8
AT0004R	St. Koloman	96.4	95.2	94.6	96.5	96.4	95.3	88.7	96.4	94.6	97.2	94.0	79.2
AT0005R	Vorhegg	95.3	95.4	95.0	96.0	95.3	95.0	96.8	96.9	96.0	97.3	96.1	96.5
AT0030R	Pillersdorf bei Retz	95.4	95.5	95.3	96.5	95.4	95.8	94.8	95.7	96.4	95.6	96.0	95.8
AT0032R	Sulzberg	94.8	95.5	100.0	100.0	100.0	100.0	100.0	99.9	99.3	99.5	99.9	100.0
AT0033R	Stolzalpe bei Murau	69.4	95.8	95.2	96.4	96.0	95.6	86.4	97.0	95.7	96.0	96.7	96.4
AT0034G	Sonnblick	96.4	97.2	96.5	96.5	96.9	96.8	54.0	92.9	99.9	96.1	96.1	97.4
AT0037R	Zillertaler Alpen	96.0	96.0	73.8	95.6	95.7	96.0	95.6	96.2	95.6	96.1	96.0	96.0
AT0038R	Gerlitzen	97.2	97.0	96.6	97.2	96.6	97.2	97.2	97.0	96.7	97.2	97.2	97.2
AT0040R	Masenberg	95.7	95.7	95.8	95.1	91.7	95.7	95.4	95.7	95.1	95.7	94.6	95.6
AT0041R	Haunsberg	93.0	100.0	100.0	100.0	100.0	99.9	99.1	100.0	100.0	100.0	99.7	99.2
AT0042R	Heidenreichstein	90.3	95.7	95.4	95.7	96.2	95.7	95.4	95.6	95.6	95.6	95.7	95.7
AT0043R	Forsthof	90.6	95.8	95.8	95.8	95.6	94.9	95.6	95.7	95.8	95.4	96.0	95.8
AT0044R	Graz Platte	99.9	96.0	99.7	13.3	96.2	87.8	89.7	91.5	72.1	94.5	85.4	95.7
AT0045R	Dunkelsteinerwald	90.3	95.5	95.0	95.6	95.7	95.3	95.4	95.6	95.7	95.4	95.7	95.7
AT0046R	Gänserndorf	79.6	95.4	95.4	95.4	97.2	98.2	95.3	95.4	95.7	88.8	78.5	95.7
AT0047R	Stixneusiedl	90.3	95.7	95.3	99.2	98.8	99.9	99.7	99.3	95.0	95.6	95.4	95.6
BE0001R	Offagne	97.6	95.2	95.0	71.2	97.3	97.8	97.2	96.6	97.6	76.3	91.7	95.7
BE0032R	Eupen	96.9	96.7	97.3	76.1	97.3	97.1	97.7	98.4	97.2	73.8	95.6	96.0
BE0035R	Vezin	96.6	97.3	97.2	83.9	97.2	97.2	96.8	97.3	97.1	97.2	85.4	84.8
CH0002R	Payerne	95.4	88.8	95.4	95.4	95.0	95.4	95.2	95.4	95.3	95.4	93.9	95.6
CH0003R	Tänikon	95.3	94.9	95.6	95.8	94.6	94.3	95.0	93.5	95.6	95.6	95.1	95.4
CH0004R	Chaumont	95.4	95.1	95.4	95.4	95.0	95.6	95.2	95.4	95.3	94.8	94.7	95.3
CH0005R	Rigi	95.3	95.5	95.2	95.3	95.0	95.3	84.7	89.0	95.4	94.8	90.1	95.4
CZ0001R	Svratouch	99.3	99.4	100.0	84.9	99.9	100.0	97.0	98.3	99.4	99.7	99.6	100.0
CZ0003R	Kosetice	99.9	100.0	100.0	99.3	99.9	100.0	86.6	99.7	96.9	99.9	99.7	100.0
DE0001R	Westerland	98.1	98.7	94.8	98.2	98.4	91.4	98.9	86.3	10.0	86.2	98.9	98.9
DE0002R	Langenbrügge	89.5	91.7	91.7	91.7	87.5	94.9	89.9	95.6	92.8	94.4	93.3	95.7
DE0003R	Schauinsland	97.0	97.3	94.4	97.4	96.6	97.1	97.2	96.2	94.3	91.7	91.8	91.8
DE0004R	Deuselbach	91.9	92.6	91.7	94.6	96.1	96.0	96.0	96.0	95.6	95.3	96.0	95.8
DE0005R	Brotjacklriegel	95.4	98.1	98.0	95.8	92.5	93.7	97.4	94.2	98.1	94.9	96.2	96.9
DE0007R	Neuglobsow	96.0	95.7	96.1	95.6	96.1	96.0	95.0	95.7	95.6	95.6	95.4	94.2
DE0008R	Schmücke	95.3	96.4	95.3	95.1	95.8	95.8	95.7	95.3	95.1	96.0	95.7	94.4
DE0009R	Zingst	96.0	100.0	100.0	95.6	98.5	96.0	96.0	96.0	95.3	95.3	95.8	95.8
DE0012R	Bassum	48.5	52.8	96.1	95.7	83.6	96.0	30.4	54.4	94.7	88.3	91.9	91.8
DE0017R	Ansbach	51.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DE0026R	Ueckermünde	96.0	96.0	96.0	95.8	96.0	85.4	84.3	96.2	89.4	87.4	88.6	93.1
DE0035R	Lückendorf	96.1	96.1	95.6	96.1	96.1	96.1	96.1	89.0	79.0	91.9	92.2	91.8
DE0039R	Aukrug	95.3	77.4	96.4	95.0	95.8	95.8	95.7	96.1	71.5	81.2	91.9	91.5
DE0042R	Öhringen	0.0	0.0	0.1	93.6	95.8	95.8	95.6	95.7	0.0	0.0	0.0	0.0
DK0005R	Keldsnor	99.6	99.7	99.2	99.6	99.5	99.3	99.5	99.2	99.7	97.8	100.0	100.0
DK0031R	Ulborg	94.8	69.3	99.7	94.3	99.9	99.7	99.7	99.6	99.9	99.6	99.9	99.5
DK0032R	Frederiksborg	99.5	99.7	99.9	99.7	98.1	99.7	99.7	46.6	99.6	99.9	96.4	99.9
DK0041R	Lille Valby	99.3	99.1	99.9	99.9	99.7	99.3	99.7	99.7	85.3	99.5	98.3	100.0
EE0009R	Lahemaa	92.7	99.7	99.7	99.4	99.7	99.7	100.0	99.7	99.7	99.7	92.9	99.3
EE0011R	Vilsandy	64.5	98.5	99.5	97.1	98.4	99.2	95.8	98.3	100.0	98.1	95.1	100.0
ES0007R	Víznar	97.8	98.4	94.8	98.5	97.8	99.3	97.7	98.3	96.7	95.0	95.6	95.6
ES0008R	Niembro	98.4	96.3	97.8	97.8	97.4	98.9	99.1	98.9	98.9	97.0	94.6	98.1
ES0009R	Campisabalos	96.4	99.1	98.0	98.6	96.1	97.4	97.3	96.1	94.0	97.4	97.5	98.7
ES0010R	Cabo de Creus	98.7	92.9	97.0	98.5	98.7	91.8	93.4	97.7	95.6	97.8	85.3	99.2
ES0011R	Barcarrola	98.3	98.5	95.3	98.9	98.0	89.9	98.8	99.2	98.8	97.8	99.4	98.9
ES0012R	Zarra	98.9	97.3	99.2	98.9	98.0	99.2	96.9	99.2	99.0	98.4	98.6	98.5
ES0013R	Palma de Mallorca	97.3	94.0	99.2	96.5	97.7	97.8	97.4	96.6	98.7	98.4	95.7	98.0
ES0014R	Els Torms	96.6	97.3	99.2	99.2	98.8	98.9	96.9	97.7	93.9	97.8	98.1	99.5
ES0015R	Risco Llamo	89.0	95.4	96.1	98.2	94.2	97.9	97.7	98.0	98.3	92.2	83.1	98.7
ES0016R	O Saviñao	0.0	0.0	97.3	98.5	93.0	98.6	93.1	92.3	95.3	89.9	94.7	98.5
FI0009R	Utö	100.0	97.9	99.9	100.0	97.3	100.0	100.0	79.4	100.0	22.3	0.0	63.4
FI0017R	Virolahti II	98.3	100.0	100.0	100.0	97.7	100.0	54.0	0.0	0.0	62.5	99.2	100.0
FI0022R	Oulanka	86.2	97.6	96.1	100.0	99.1	99.9	93.8	98.3	99.9	100.0	87.9	100.0
FI0037R	Ahtari II	95.7	100.0	100.0	100.0	98.3	100.0	98.5	100.0	95.7	96.2	79.2	98.9
FR0008A	Donon	98.3	98.1	98.0	96.0	98.4	98.6	96.0	98.3	98.2	95.7	98.5	98.4
FR0008B	Donon	98.1	98.2	98.4	96.1	98.4	98.5	95.8	98.4	98.5	95.3	98.5	98.4
FR0008C	Donon	99.7	99.7	99.7	23.5	99.6	100.0	97.2	99.9	88.3	92.1	99.9	100.0
FR0008D	Donon	99.7	99.6	99.7	97.4	99.7	100.0	97.2	100.0	99.9	97.0	99.9	99.9
FR0009R	Revin	99.6	99.4	99.1	99.4	99.3	83.3	99.2	99.1	99.4	77.0	99.4	99.6
FR0010R	Morvan	99.1	99.1	98.7	92.1	99.3	96.8	92.6	95.2	99.4	98.4	98.5	98.7
FR0012R	Iraty	99.3	95.7	84.0	99.3	70.4	97.8	85.8	84.3	99.0	86.4	99.3	99.5
FR0013R	Peyrusse Vieille	100.0	98.2	98.4	99.7	99.2	100.0	99.7	86.4	76.1	99.7	100.0	100.0
FR0014R	Montandon	98.4	92.7	0.0	66.1	96.1	98.1	97.4	98.0	98.5	97.7	97.5	93.8
GB0002R	Eskdalemuir	99.7	99.4	99.3	99.9	95.4	99.9	99.6	100.0	100.0	100.0	99.3	99.5
GB0006R	Lough Navar	99.7	99.9	99.6	99.7	99.7	97.6	92.3	99.6	99.9	99.9	99.0	99.6

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB0013R	Yarner Wood	99.5	99.6	99.9	99.7	98.7	99.9	99.9	99.7	81.3	80.2	99.3	100.0
GB0014R	High Muffles	99.7	42.6	0.0	14.6	99.1	99.6	99.9	99.7	96.5	99.1	99.0	99.2
GB0015R	Strath Vaich Dam	99.6	84.7	100.0	99.7	97.7	0.0	0.0	79.0	100.0	0.0	0.0	42.5
GB0031R	Aston Hill	99.7	99.9	86.2	95.0	88.6	99.0	98.1	99.6	99.4	99.9	24.0	0.0
GB0032R	Bottesford	99.6	99.7	99.5	99.4	99.7	98.5	99.3	99.3	99.2	99.5	99.4	99.3
GB0033R	Bush	99.7	95.4	99.6	91.8	97.6	99.7	99.7	99.5	99.9	99.9	96.7	98.8
GB0034R	Glazebury	99.7	99.7	99.7	99.9	96.6	98.3	82.0	97.6	99.9	99.7	99.6	100.0
GB0036R	Harwell	98.7	96.1	99.3	99.2	95.6	99.4	80.8	98.9	99.3	98.4	99.6	96.2
GB0037R	Ladybower Res.	81.0	67.7	0.0	0.0	0.0	0.0	59.0	40.6	99.7	99.5	96.9	99.9
GB0038R	Lullington Heath	96.4	99.6	99.5	97.5	95.4	98.9	99.1	92.7	98.3	97.0	95.0	97.4
GB0039R	Sibton	99.3	99.6	99.9	100.0	94.5	99.9	99.5	99.1	99.9	99.7	99.9	96.2
GB0043R	Narberth	98.9	85.7	85.6	98.2	99.6	98.8	90.2	93.4	88.6	94.2	95.0	95.3
GB0044R	Somerton	99.5	99.4	98.7	99.7	95.7	99.7	85.6	98.4	96.0	99.7	99.2	99.7
GB0045R	Wicken Fen	98.9	97.8	99.3	98.8	79.7	99.2	99.6	79.4	62.9	73.8	99.4	99.7
GR0002R	Finokalia	85.3	91.5	16.8	22.6	63.3	97.8	75.0	91.5	88.2	91.0	93.2	81.9
HU0002R	K-puszta	100.0	91.7	99.7	97.8	99.9	99.0	78.5	93.5	63.2	98.5	92.1	100.0
IE0031R	Mace Head	99.9	100.0	99.7	99.6	99.9	96.8	97.0	99.7	100.0	99.6	99.9	100.0
IT0001R	Montelibretti	98.1	97.9	87.4	96.0	100.0	96.0	95.8	82.8	84.7	83.2	98.6	68.3
IT0004R	Ispra	99.7	99.4	99.2	99.2	98.3	99.3	97.7	96.6	97.8	99.6	99.2	98.4
LT0015R	Preila	98.9	100.0	100.0	100.0	100.0	100.0	100.0	90.7	97.4	100.0	100.0	100.0
LV0010R	Rucava	99.1	97.5	99.1	99.0	99.6	20.8	0.0	74.7	84.3	97.8	95.6	98.7
MT0001R	Giordan lighthouse	99.9	98.5	99.5	99.7	99.7	76.4	99.3	99.7	78.3	68.0	99.6	96.5
NL0009R	Kollumerwaard	97.6	99.9	98.0	96.9	99.5	99.6	96.6	98.5	71.3	65.7	86.1	78.4
NL0010R	Vredepeel	97.8	99.7	91.7	99.2	98.9	99.0	98.1	93.1	81.0	92.1	80.4	66.9
NO0001R	Birkenes	100.0	99.0	100.0	100.0	99.3	99.9	100.0	99.1	100.0	98.1	99.7	97.3
NO0015R	Tustervatn	100.0	99.7	100.0	100.0	100.0	100.0	99.7	100.0	100.0	100.0	100.0	99.9
NO0039R	Kårvatn	99.6	100.0	100.0	99.7	99.9	99.9	94.9	100.0	100.0	100.0	99.6	99.5
NO0041R	Osen	98.7	100.0	100.0	100.0	100.0	99.9	97.3	94.2	100.0	99.6	96.2	99.9
NO0042G	Spitsbergen, Zeppelinfjell	73.9	97.2	99.9	99.9	99.7	96.7	99.7	99.2	97.8	96.9	99.7	99.9
NO0043R	Prestebakke	100.0	100.0	87.4	100.0	100.0	99.0	96.9	100.0	100.0	99.2	100.0	99.9
NO0045R	Jeløya	99.6	72.6	100.0	100.0	100.0	100.0	100.0	99.7	100.0	100.0	99.7	99.9
NO0048R	Voss	100.0	99.6	99.6	100.0	100.0	99.4	100.0	95.3	99.6	99.7	99.6	99.9
NO0052R	Sandve	100.0	99.6	99.7	100.0	100.0	98.9	99.7	100.0	99.3	100.0	99.4	99.9

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NO0055R	Karasjok	99.3	100.0	99.7	100.0	100.0	100.0	99.7	100.0	100.0	99.9	100.0	99.9
NO0056R	Hurdal	99.7	99.6	75.8	100.0	100.0	99.2	100.0	91.7	99.4	98.8	97.9	99.2
PL0002R	Jarczew	100.0	98.8	99.6	100.0	99.9	100.0	100.0	100.0	98.2	99.6	100.0	100.0
PL0003R	Sniezka	100.0	100.0	100.0	100.0	100.0	100.0	99.1	99.9	100.0	100.0	100.0	97.6
PL0004R	Leba	100.0	100.0	99.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.7	100.0
PL0005R	Diabla Gora	69.2	98.8	100.0	99.4	97.2	99.2	98.7	100.0	99.6	100.0	99.6	97.6
PT0004R	Monte Velho	99.1	98.2	89.1	96.4	94.0	97.1	92.1	92.7	93.3	84.1	88.5	95.3
RU0016R	Shepeljovo	81.7	83.6	98.7	78.5	99.1	100.0	82.8	18.4	51.9	0.1	74.0	80.5
RU0018R	Danki	0.4	100.0	100.0	99.6	0.4	99.7	99.9	98.9	0.0	0.0	0.0	0.0
SE0002R	Rörvik	99.3	83.3	99.9	99.2	98.4	99.9	100.0	99.9	92.9	99.1	98.5	98.4
SE0011R	Vavihill	99.3	100.0	100.0	100.0	99.3	99.9	99.9	99.5	99.9	99.3	99.9	100.0
SE0012R	Aspvreten	53.6	92.1	96.1	79.9	85.9	89.7	90.3	81.9	92.8	98.8	99.7	95.2
SE0013R	Esrange	99.9	99.7	100.0	100.0	100.0	99.2	100.0	100.0	99.9	99.5	99.9	100.0
SE0032R	Norra-Kvill	96.1	99.1	99.3	99.4	72.7	100.0	95.3	100.0	96.0	93.5	98.8	100.0
SE0035R	Vindeln	100.0	100.0	99.1	100.0	99.7	99.2	100.0	99.9	98.9	99.1	99.2	100.0
SE0039R	Grimsö	99.1	100.0	100.0	62.2	95.2	100.0	100.0	100.0	99.9	100.0	99.2	99.9
SI0008R	Iskrba	75.5	83.9	81.9	80.7	93.8	90.7	98.4	91.4	94.0	97.3	92.8	92.9
SI0031R	Zarodnje	94.8	89.4	93.4	93.1	84.7	89.2	92.9	86.3	81.4	84.0	93.9	86.4
SI0032R	Krvavec	95.6	95.4	99.9	98.9	69.8	93.9	78.8	99.7	99.3	98.9	98.5	99.6
SI0033R	Kovk	89.9	88.5	87.4	80.8	90.3	86.9	89.1	79.4	84.9	73.8	92.4	70.3
SK0004R	Stará Lesná	100.0	100.0	100.0	100.0	99.3	88.9	98.4	99.5	90.6	99.7	100.0	100.0
SK0006R	Starina	69.6	99.4	99.9	97.2	100.0	99.9	99.5	99.6	100.0	100.0	100.0	100.0
SK0007R	Topolniky	99.9	100.0	99.7	63.9	71.6	59.9	16.7	90.6	99.9	99.9	75.0	58.7

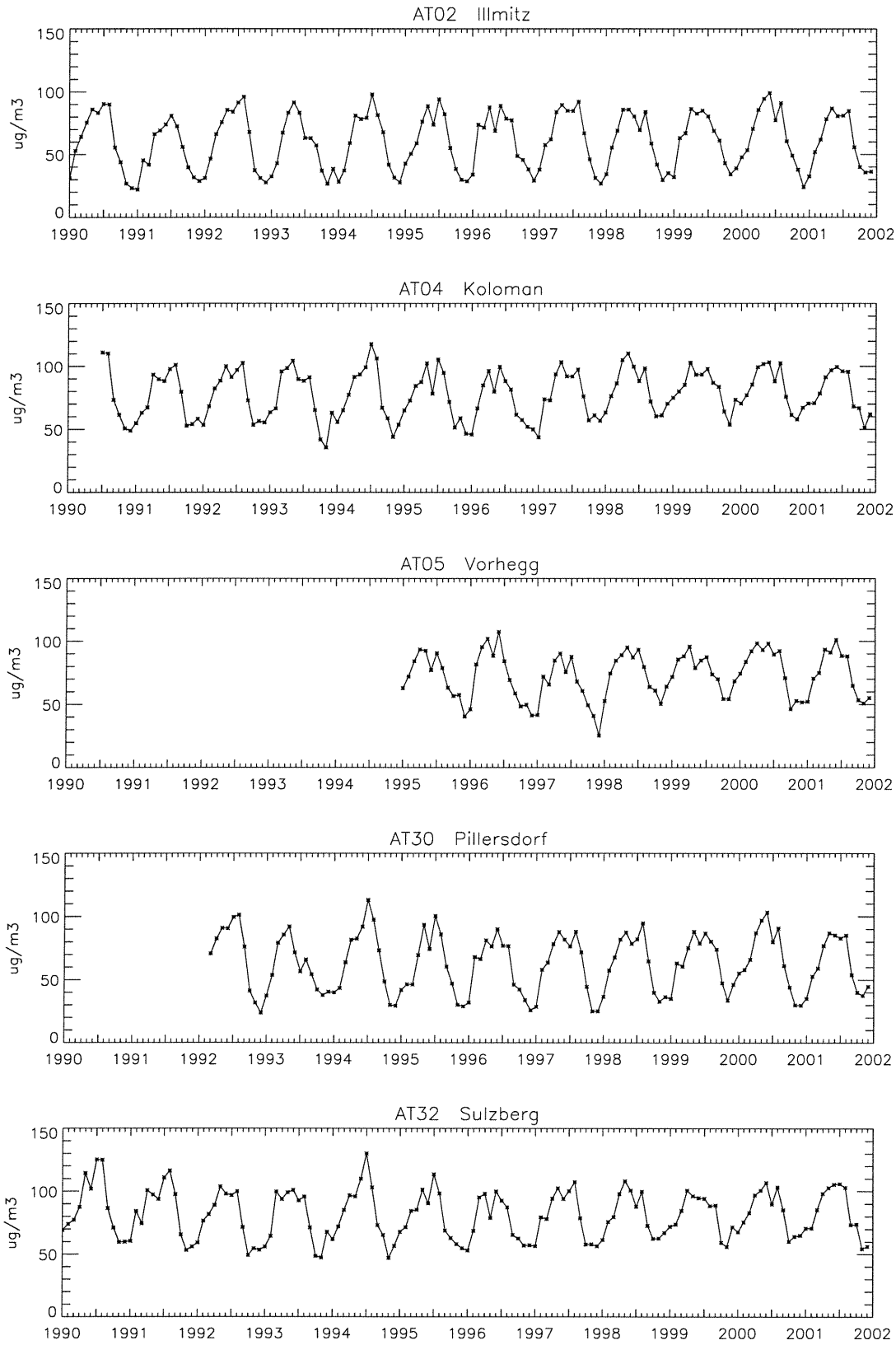


Figure 3.1: Seasonal variation, 1990–2001.

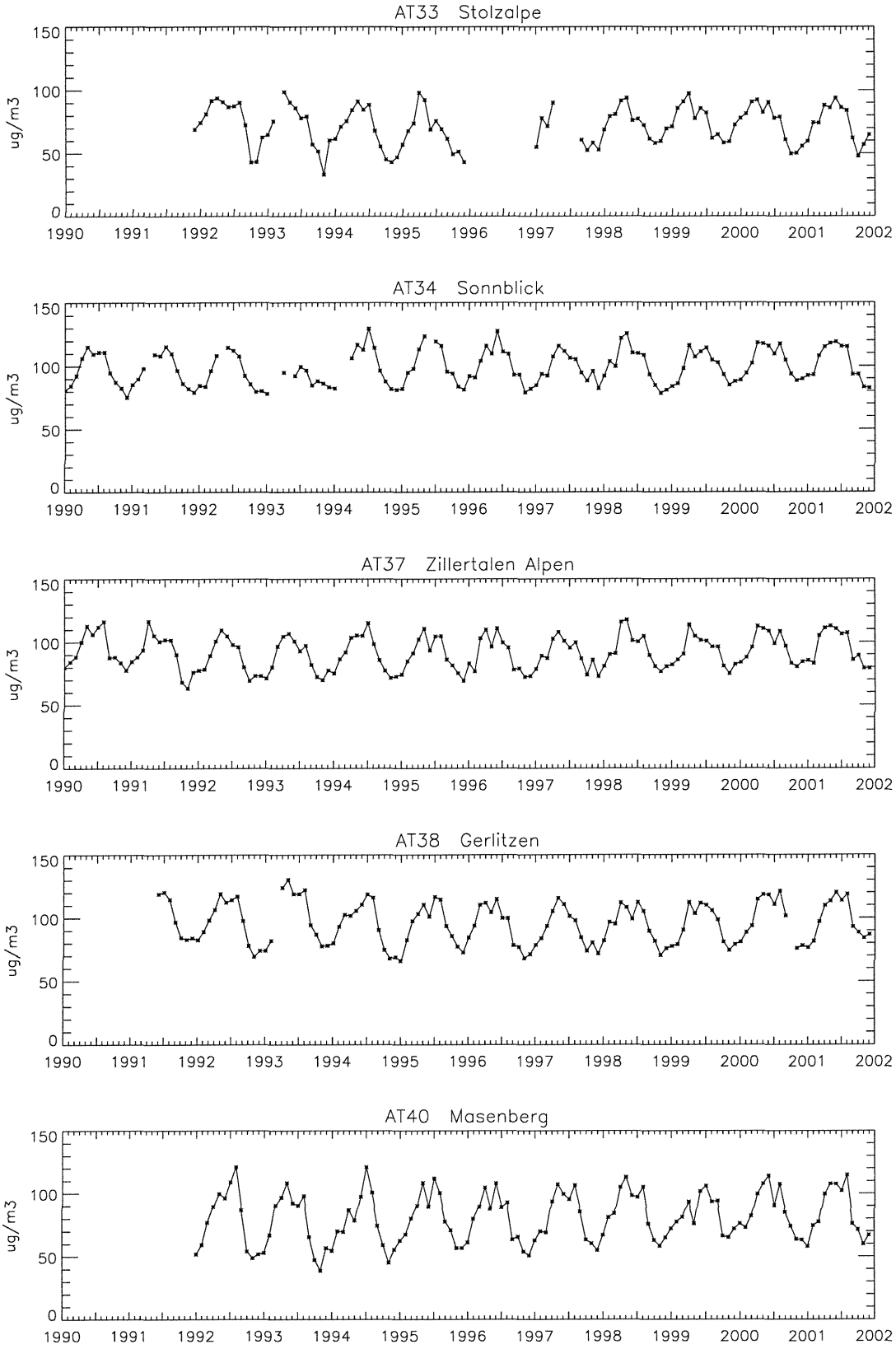


Figure 3.1, cont.

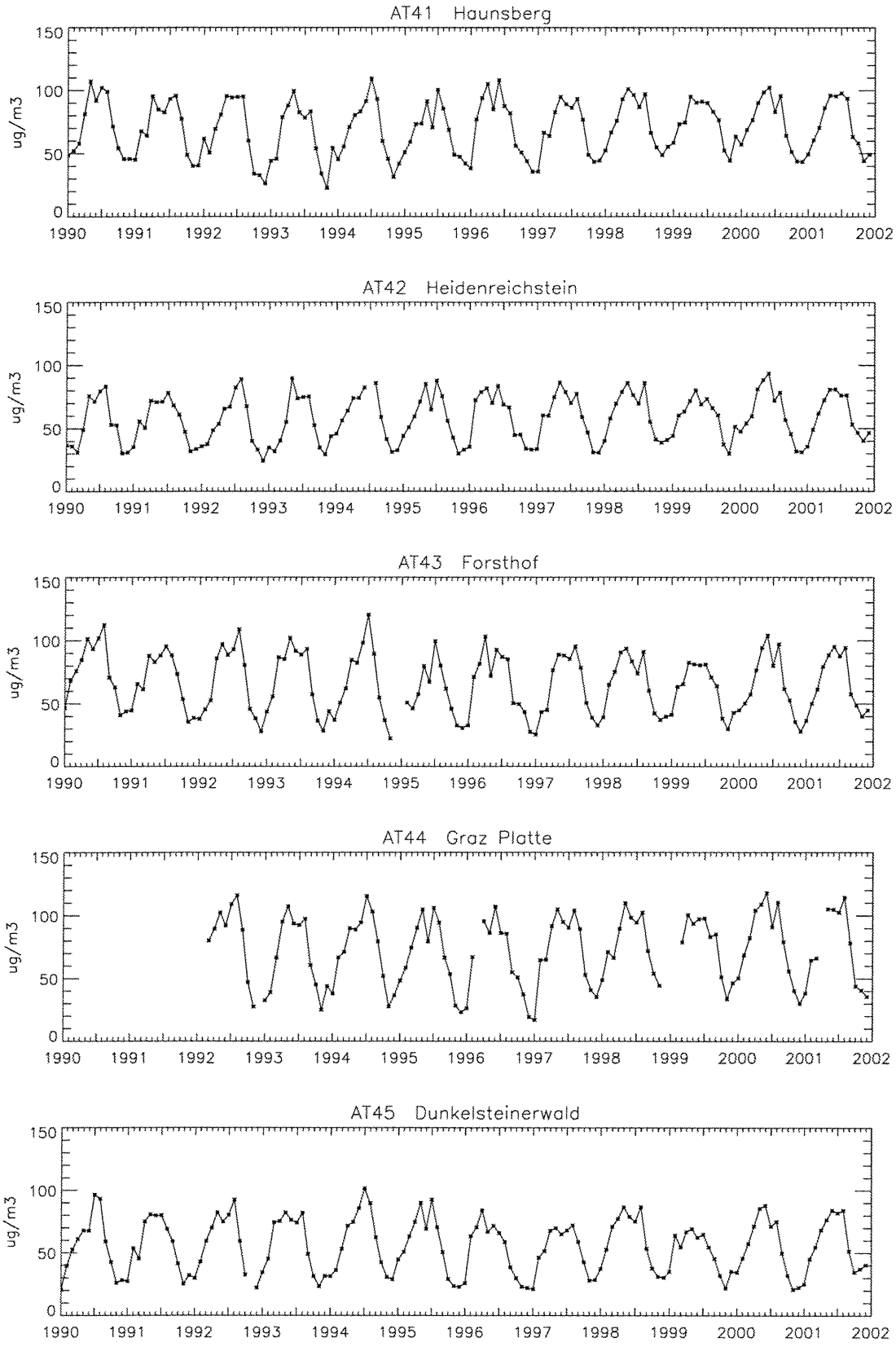


Figure 3.1, cont.

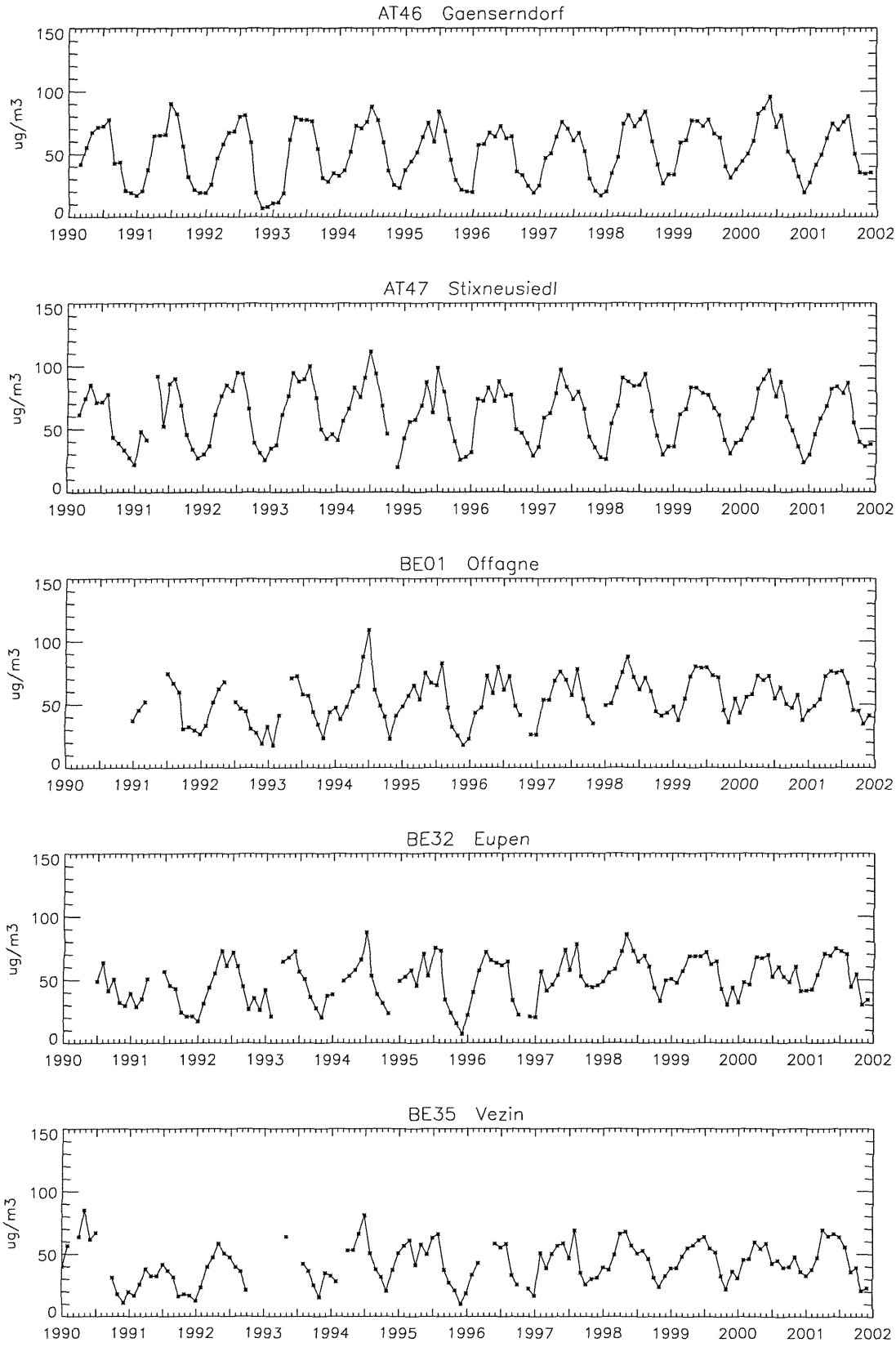
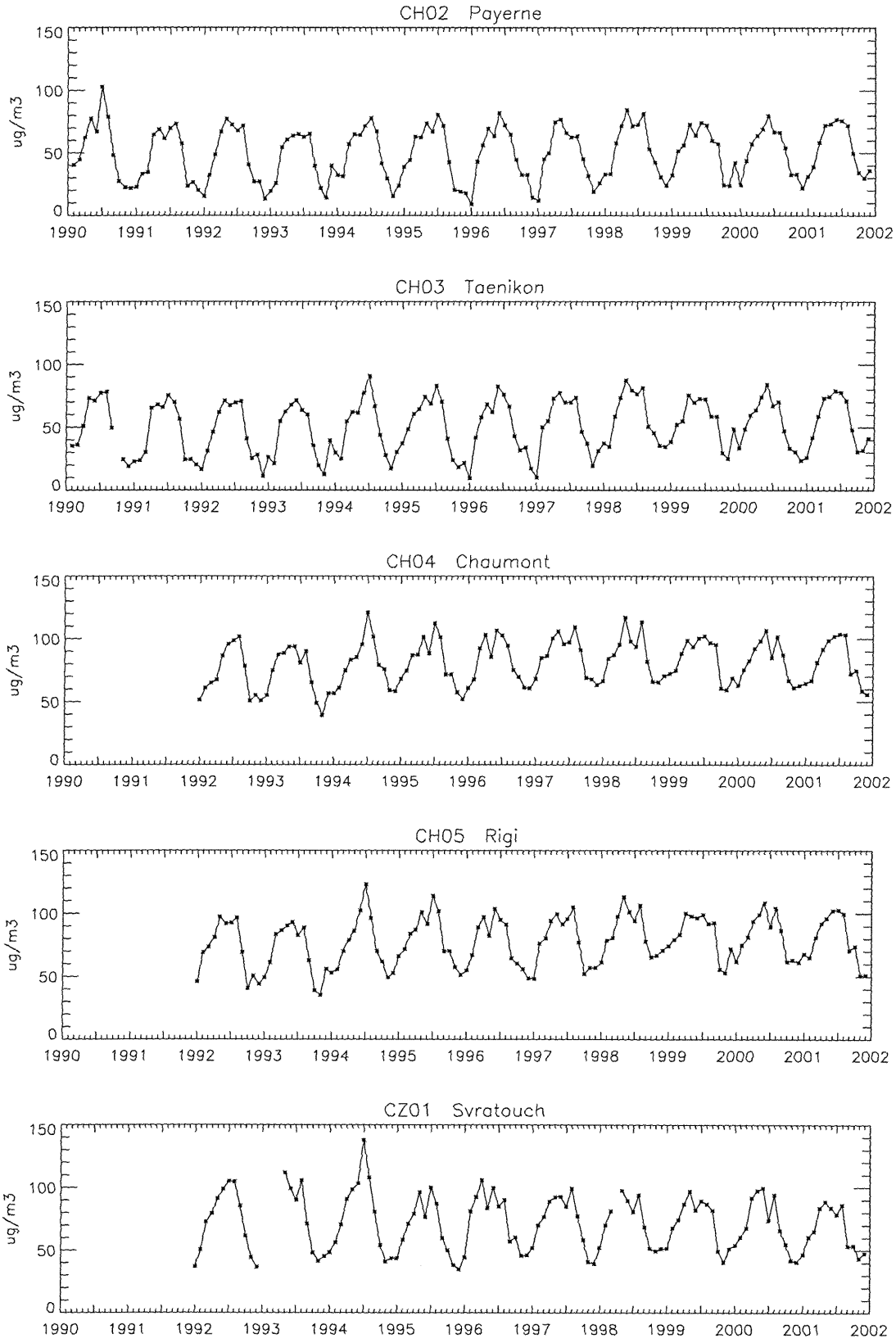


Figure 3.1, cont.



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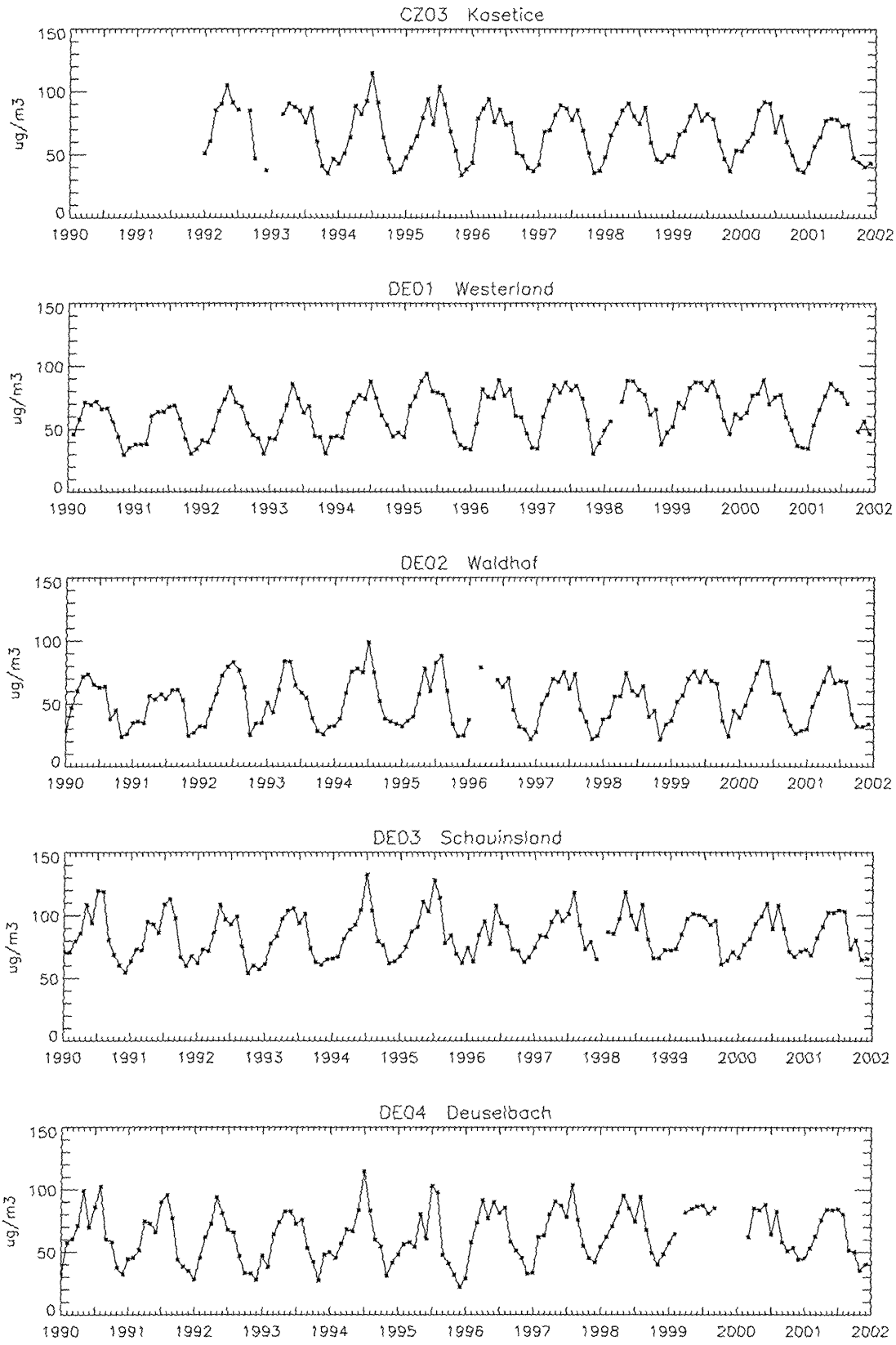


Figure 3.1, cont.

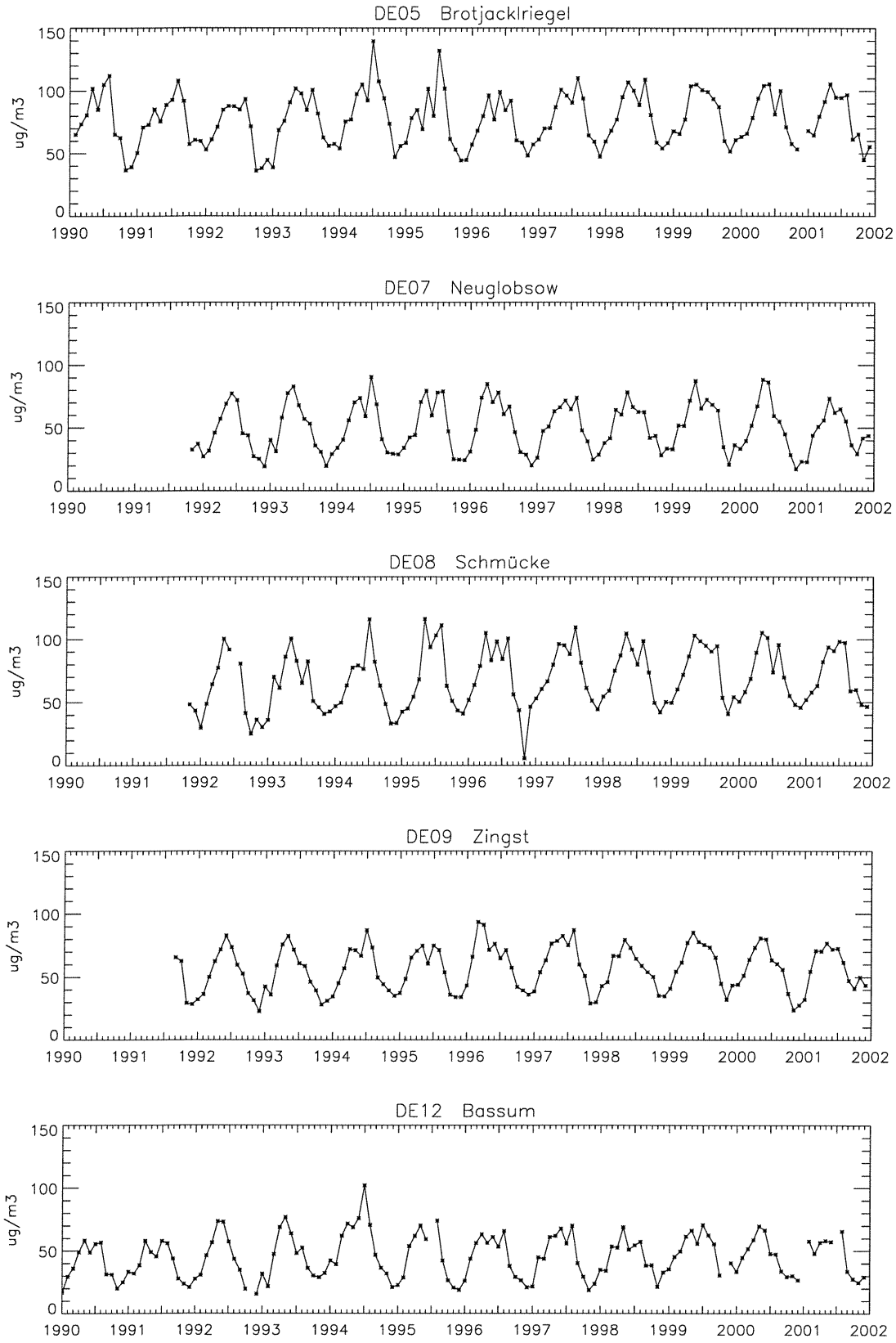


Figure 3.1, cont.

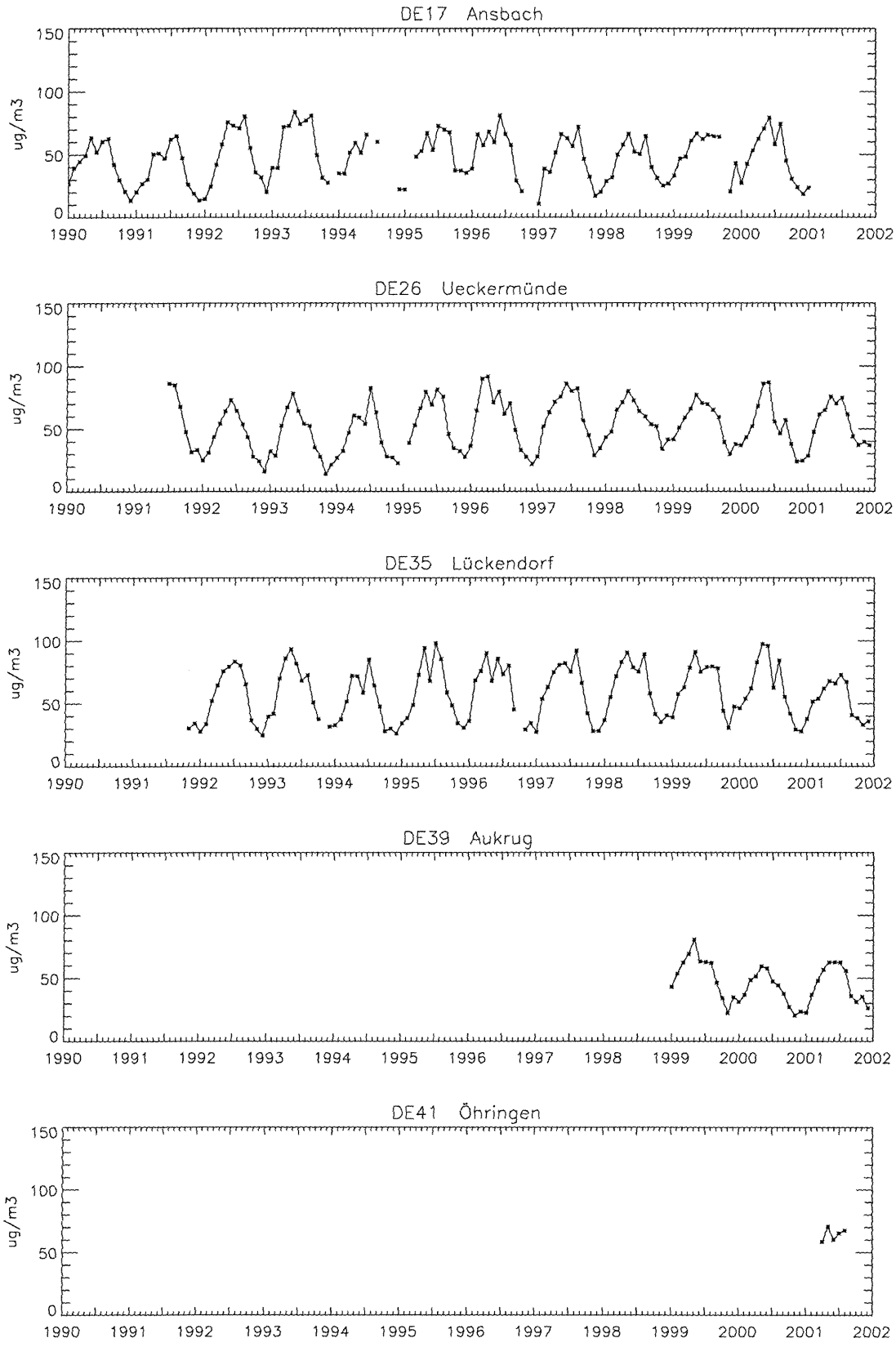


Figure 3.1, cont.

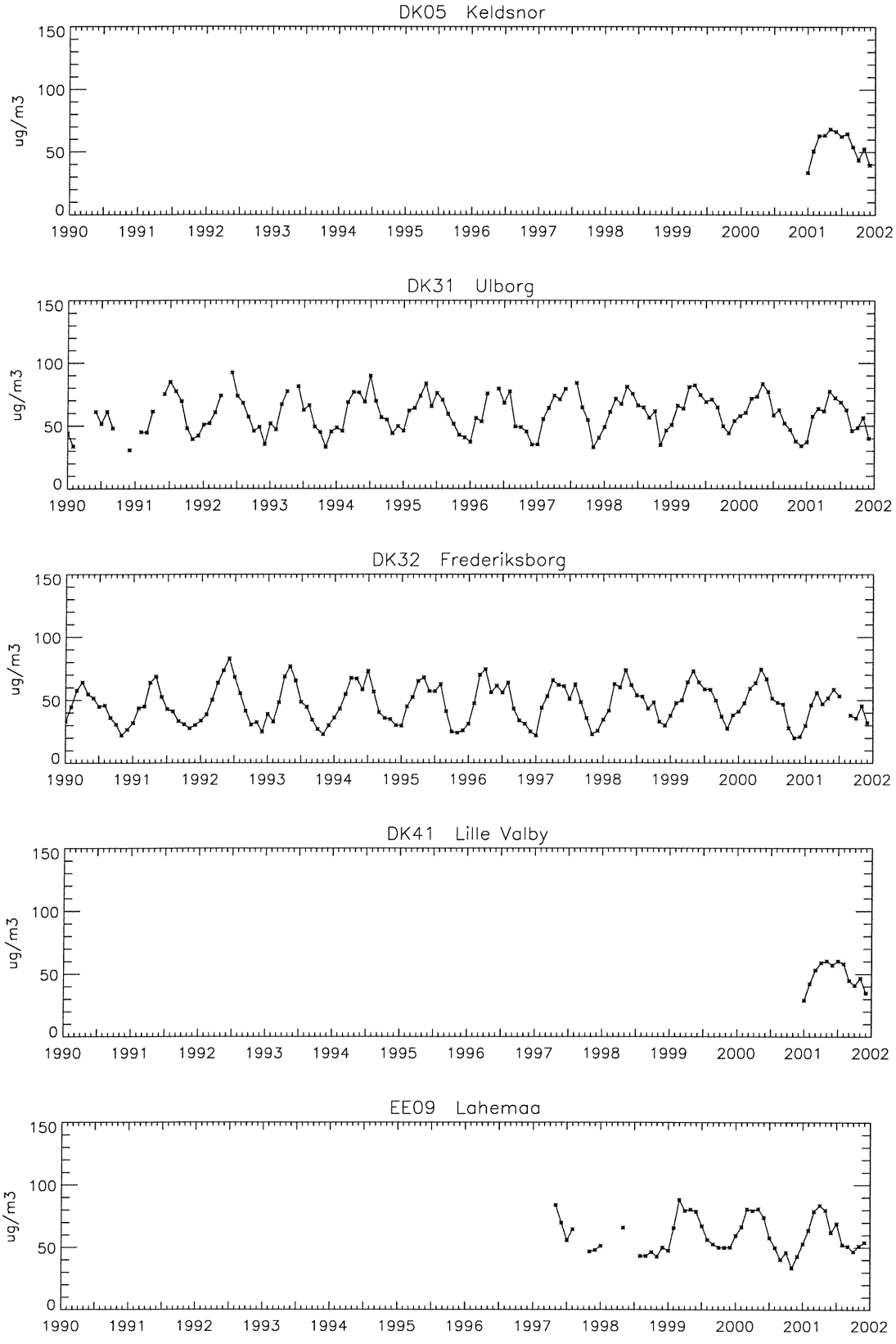
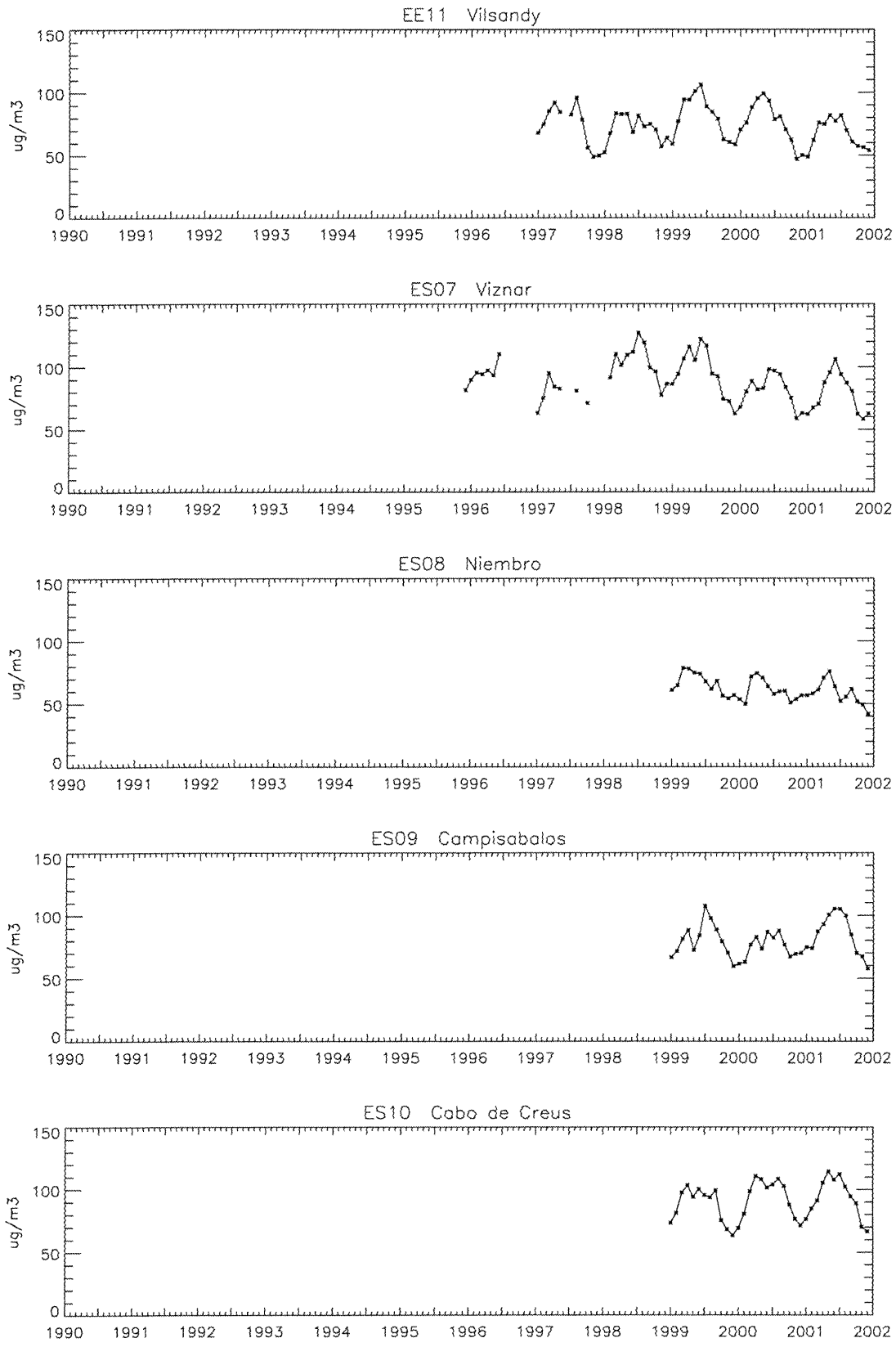


Figure 3.1, cont.



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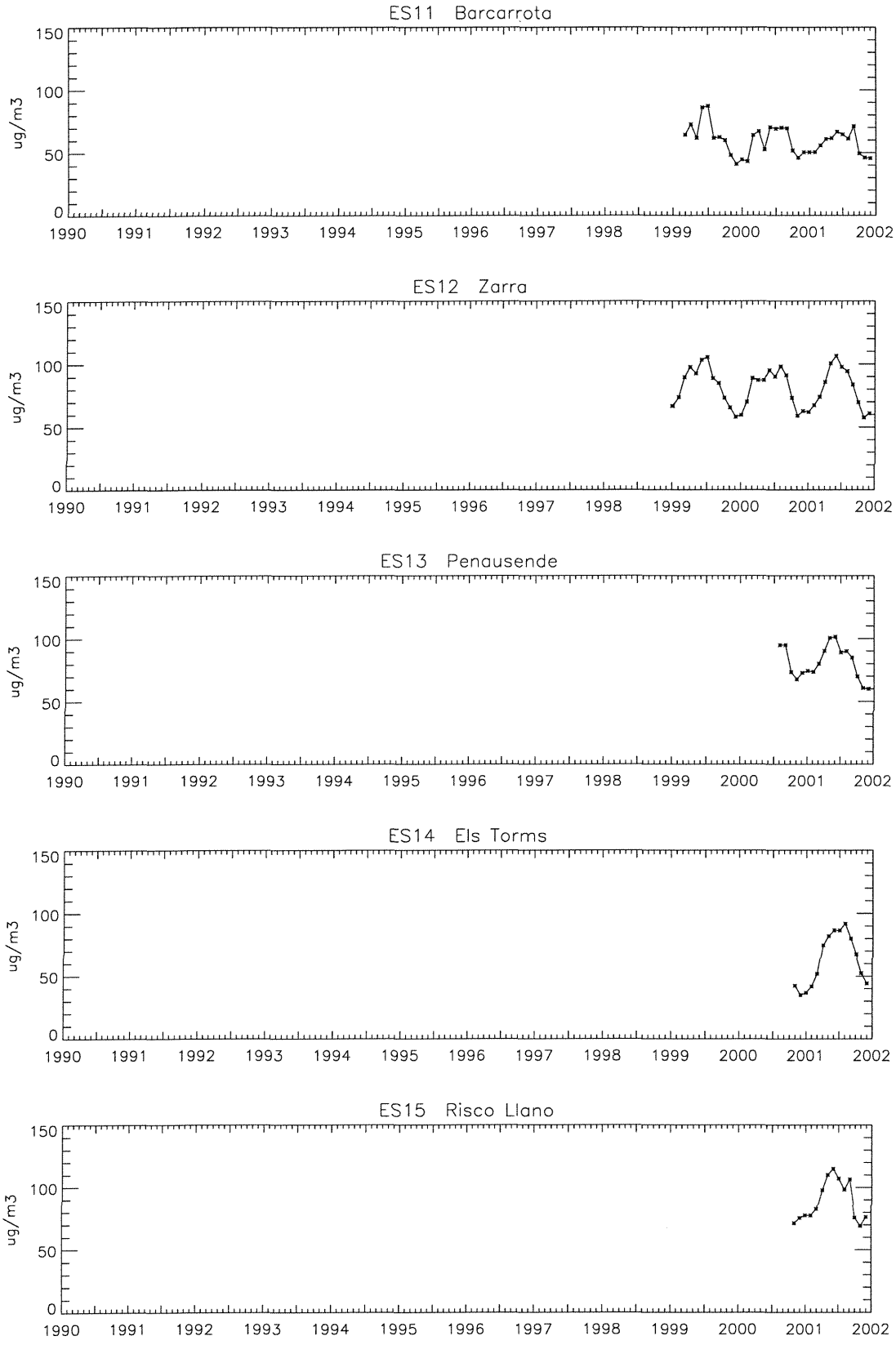


Figure 3.1, cont.

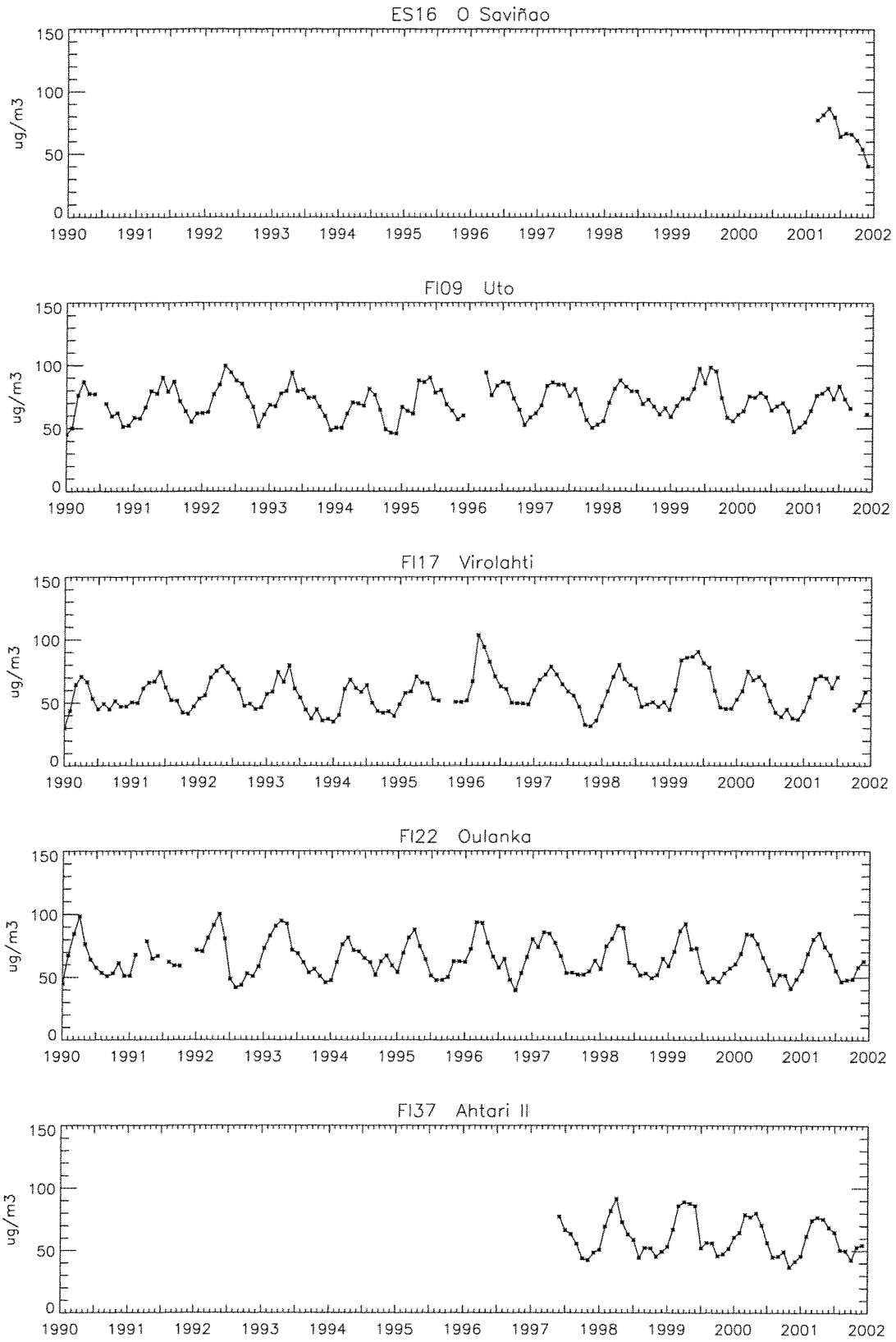


Figure 3.1, cont.

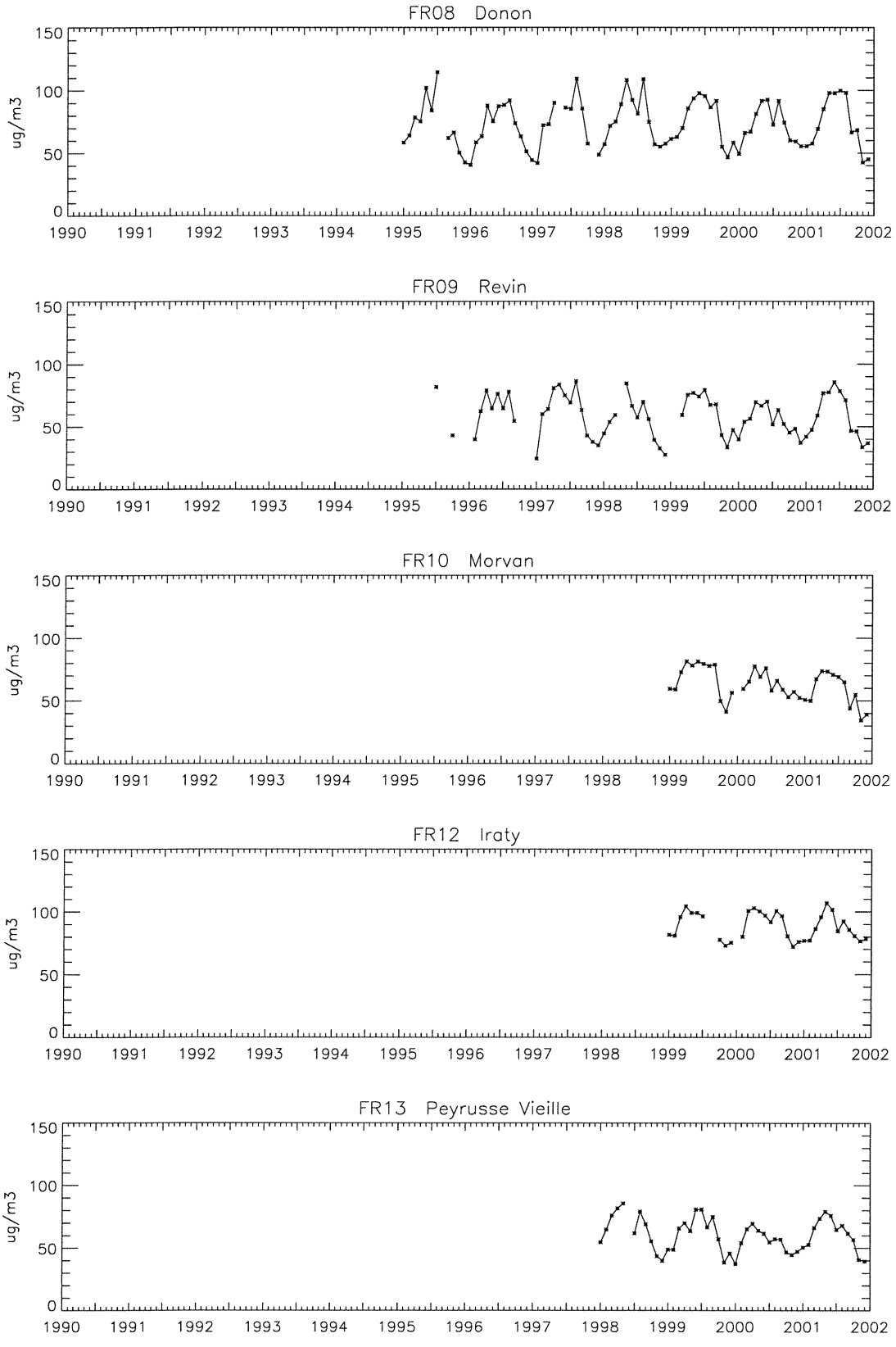


Figure 3.1, cont.

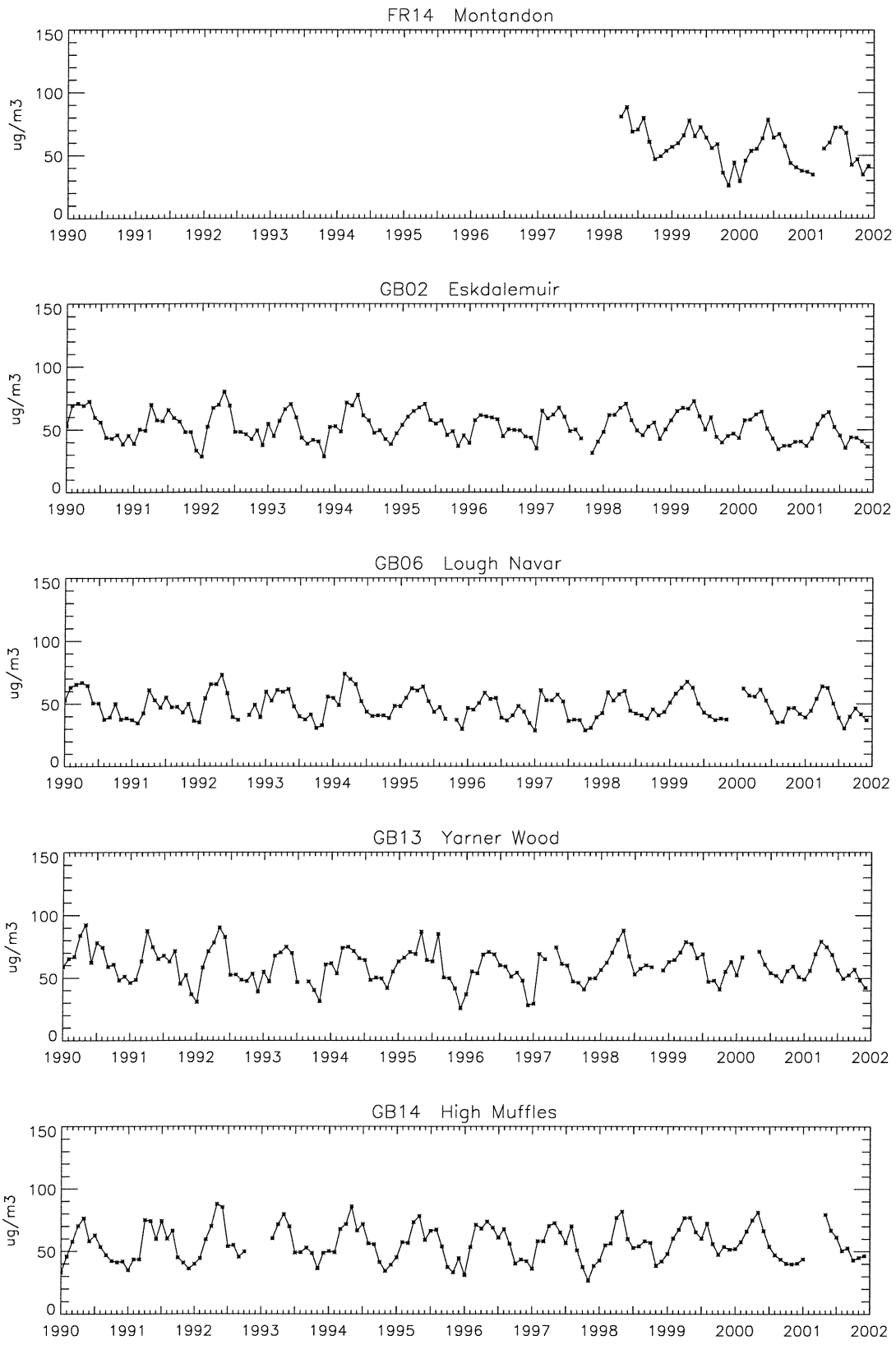


Figure 3.1, cont.

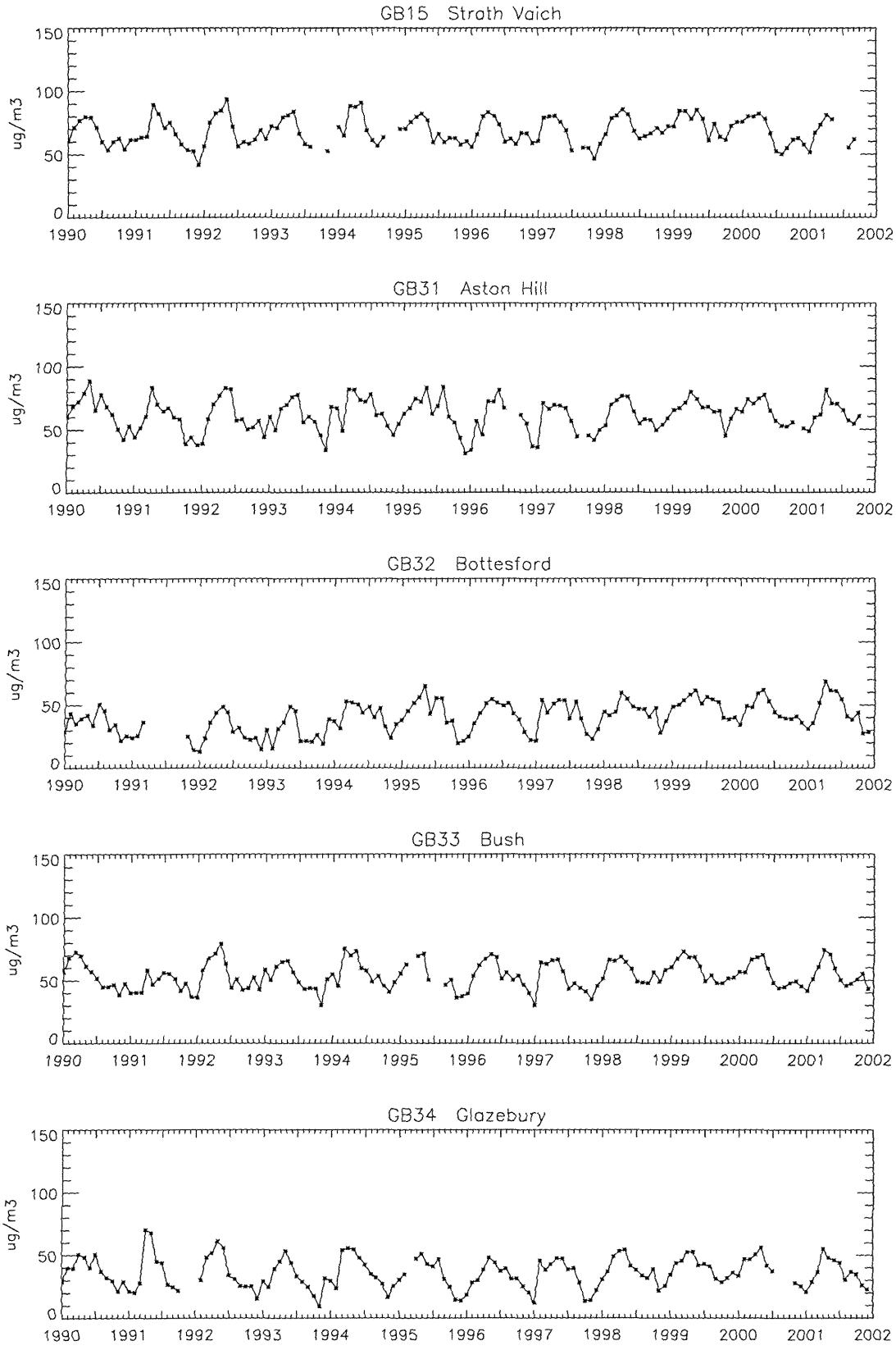


Figure 3.1, cont.

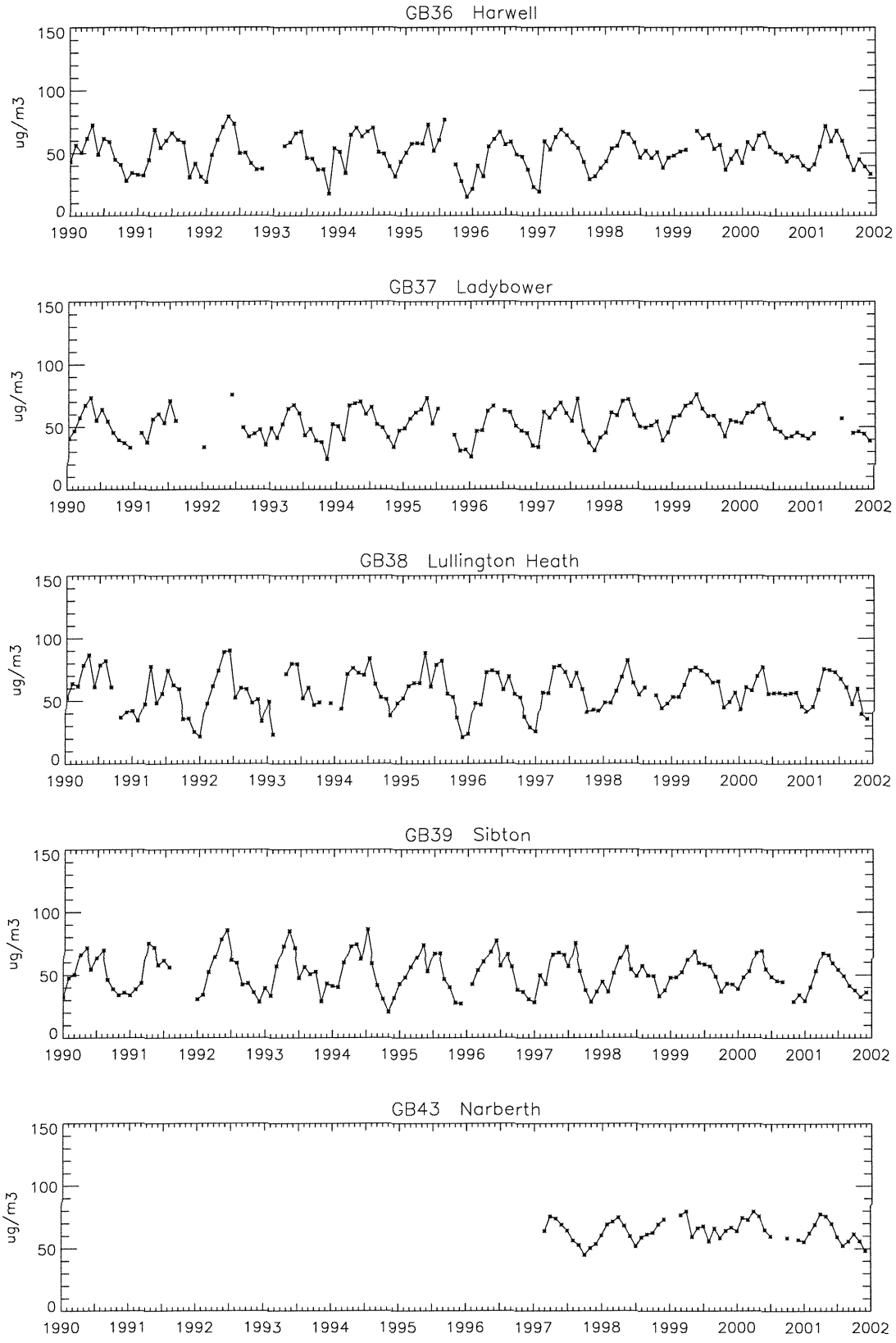


Figure 3.1, cont.

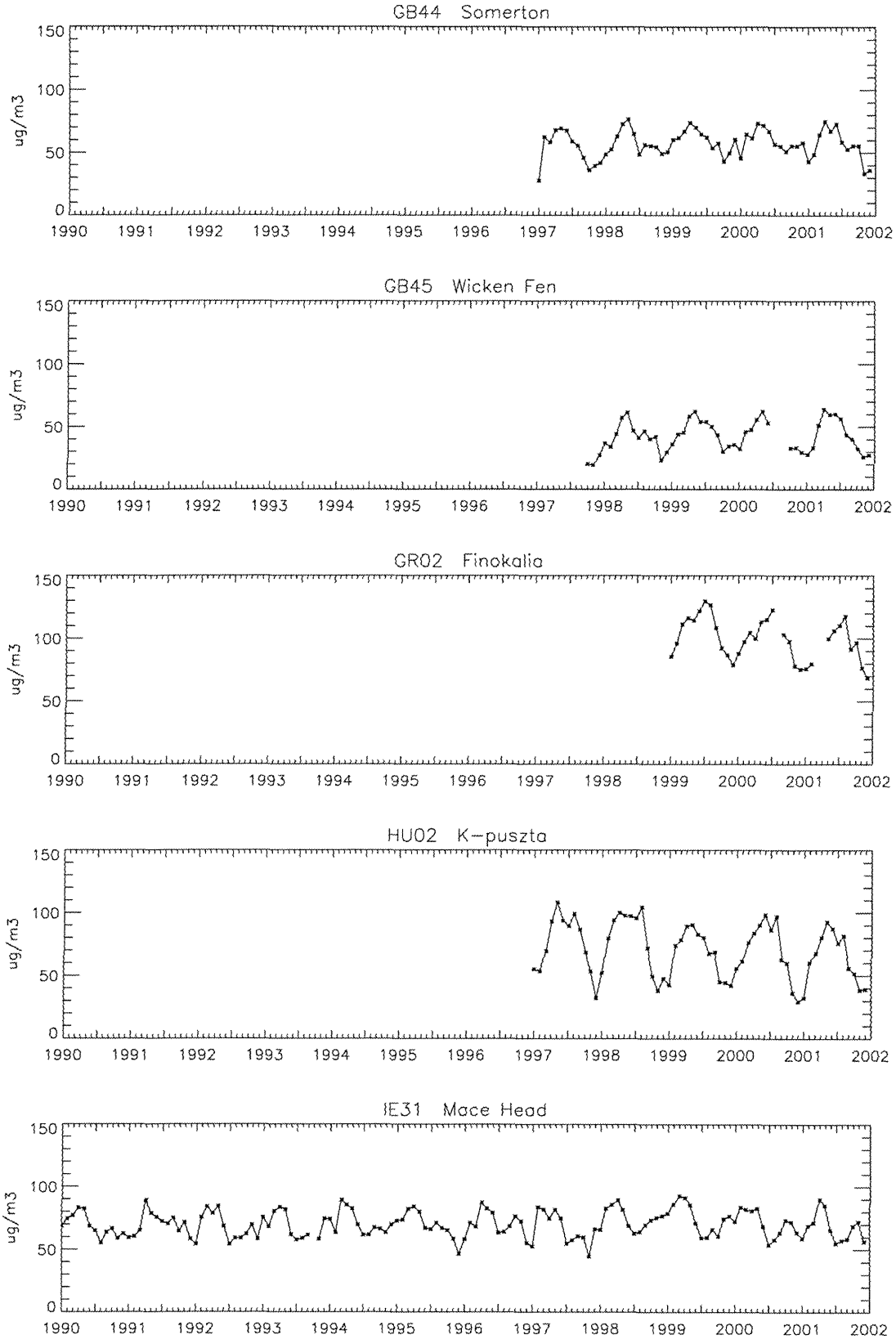
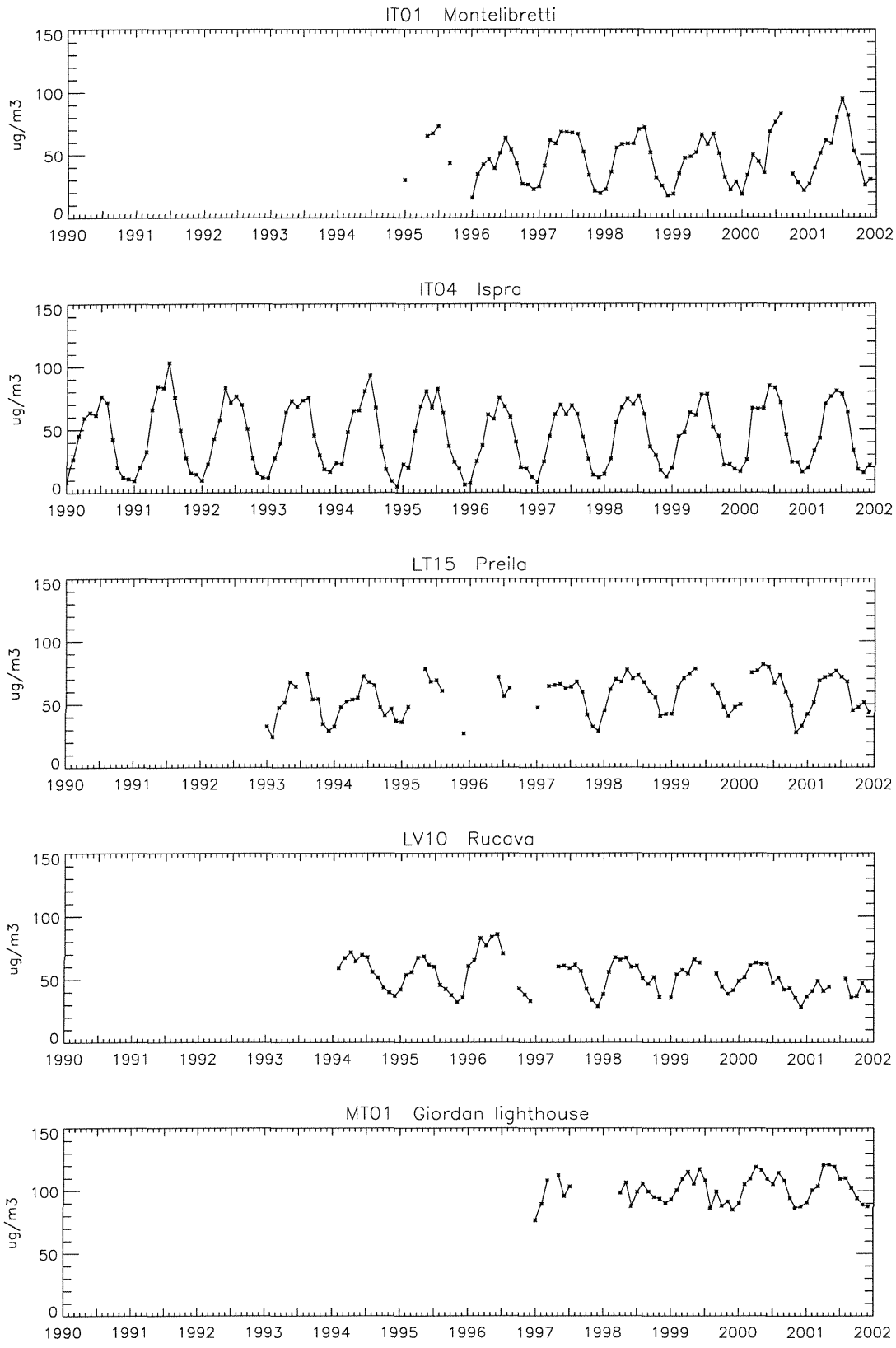


Figure 3.1, cont.



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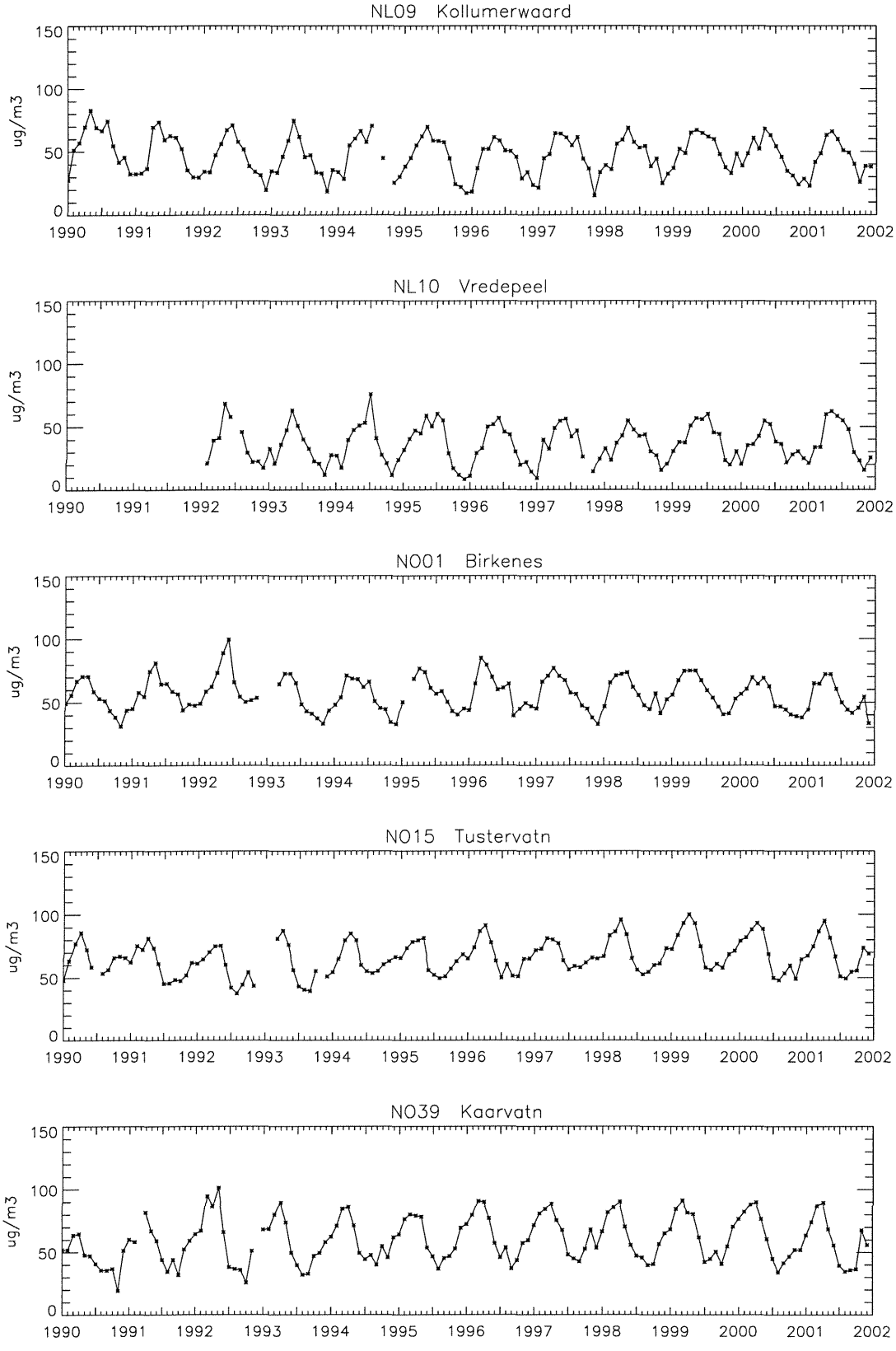

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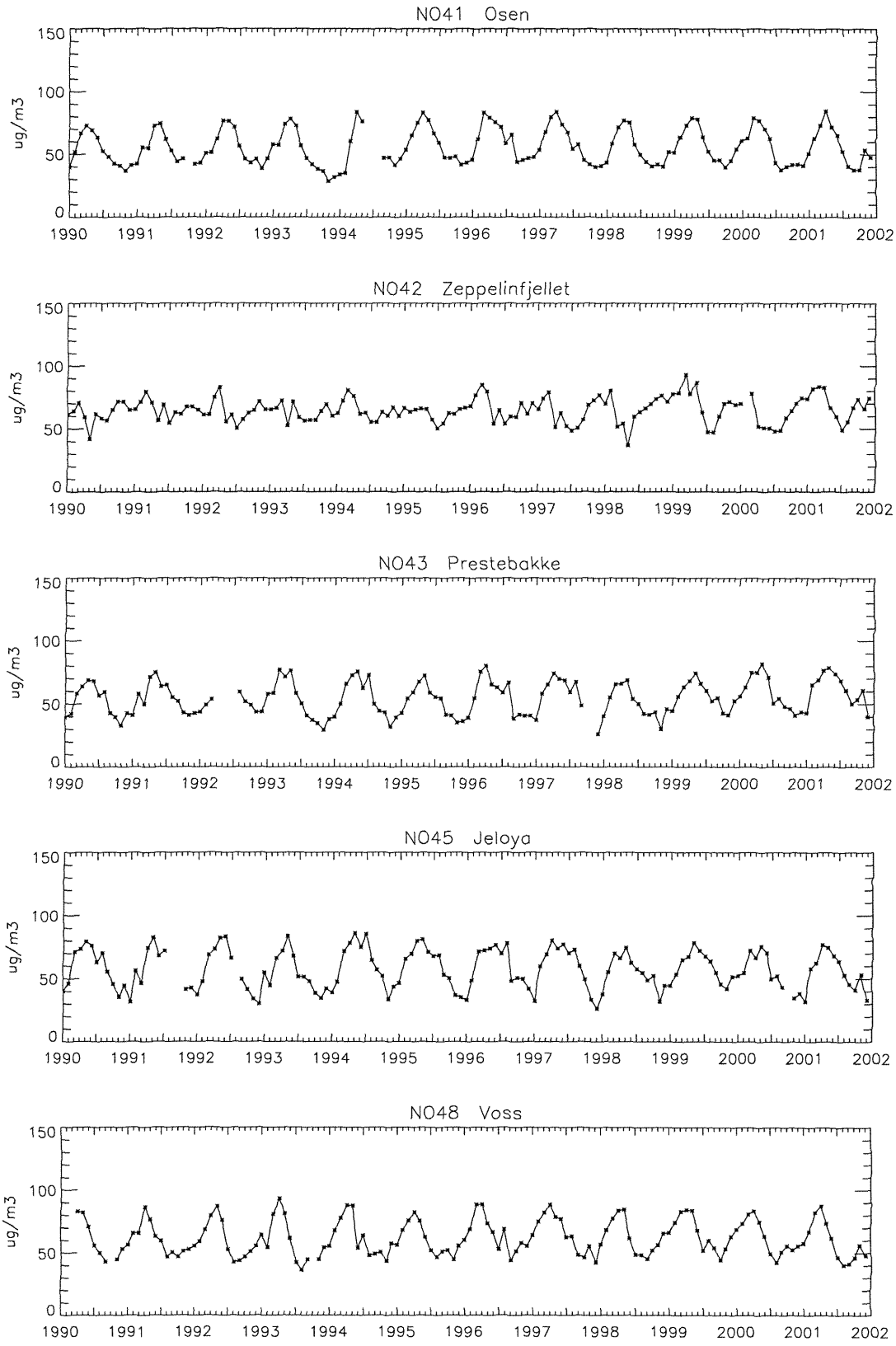

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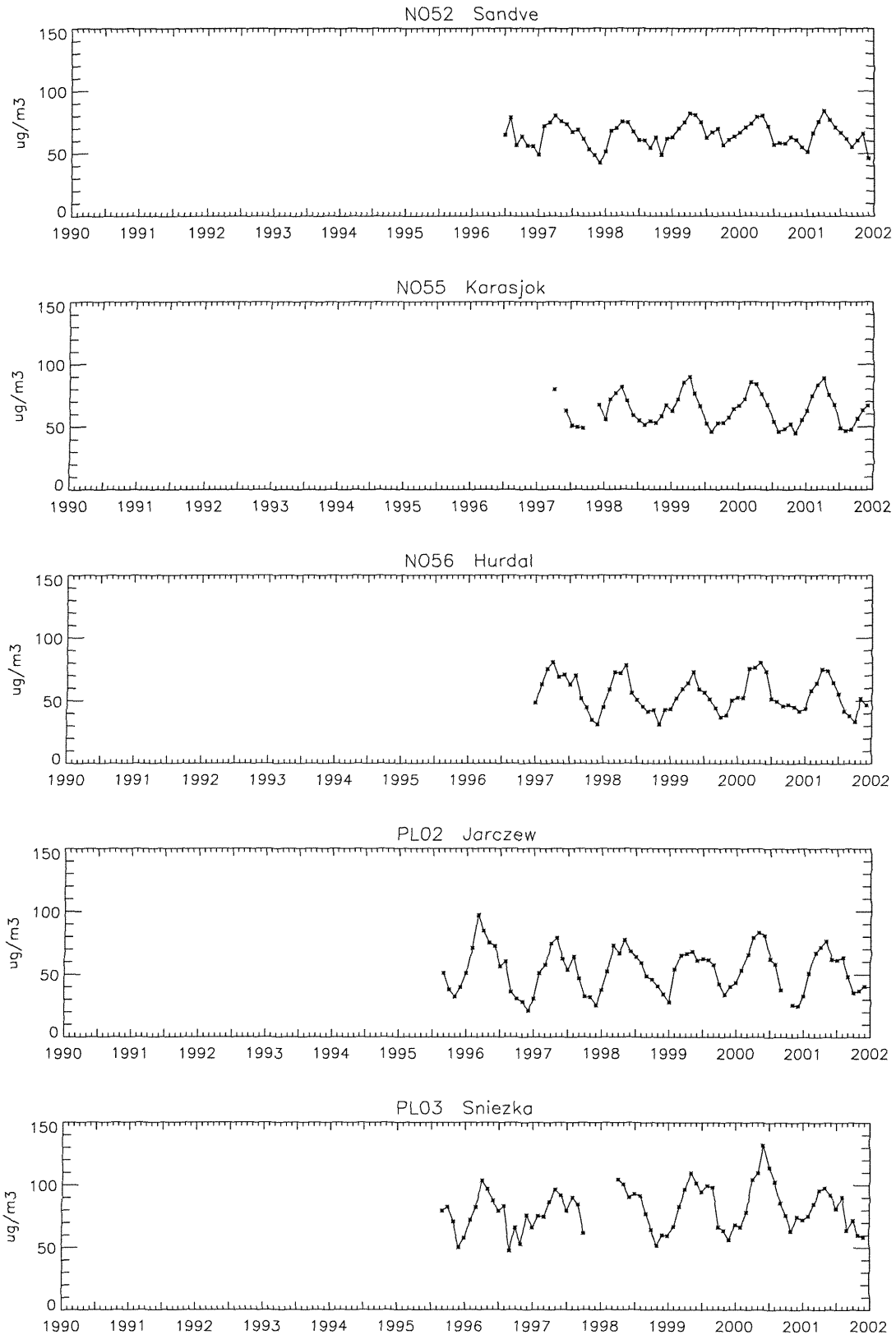

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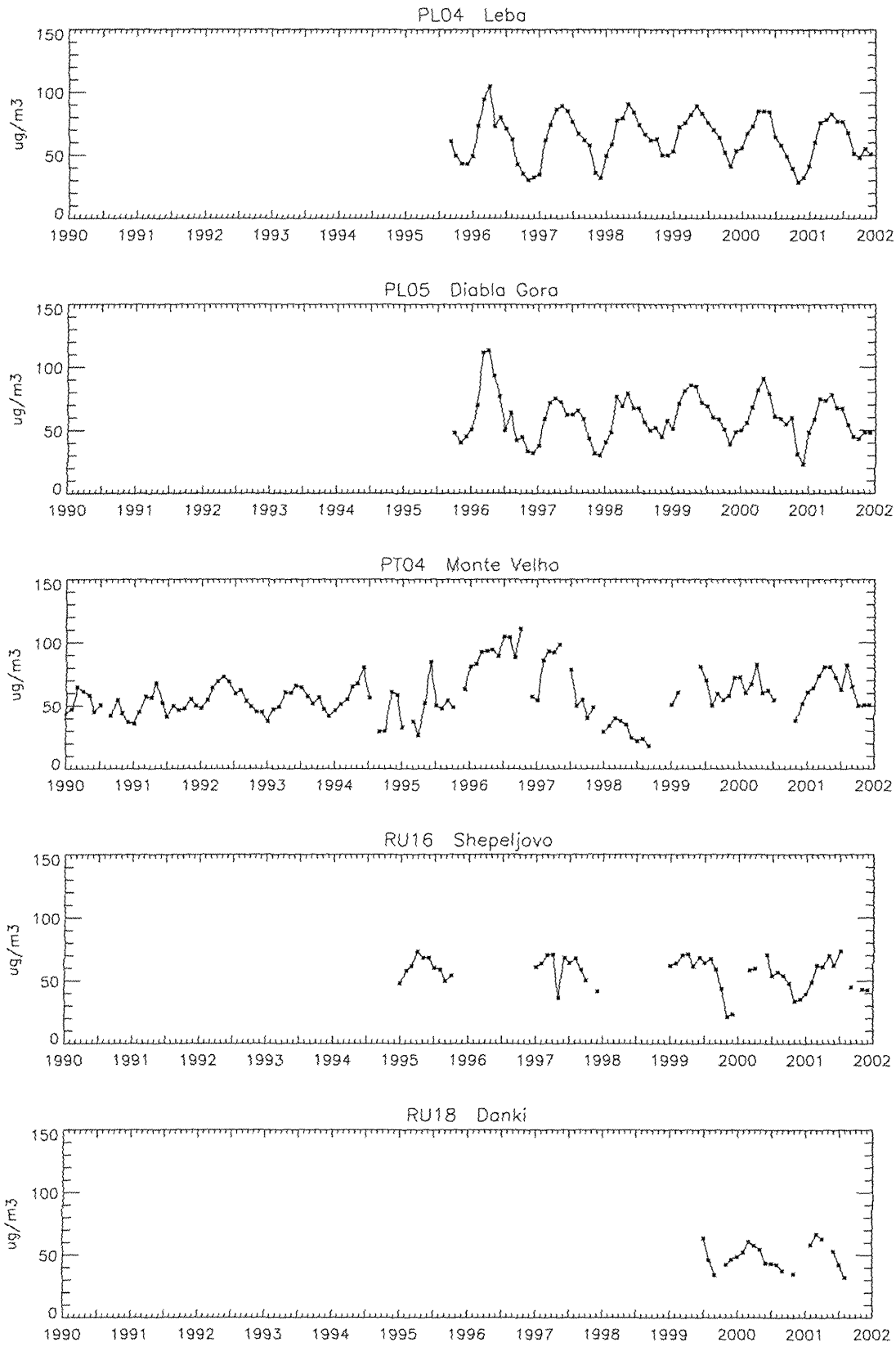


Figure 3.1, cont.

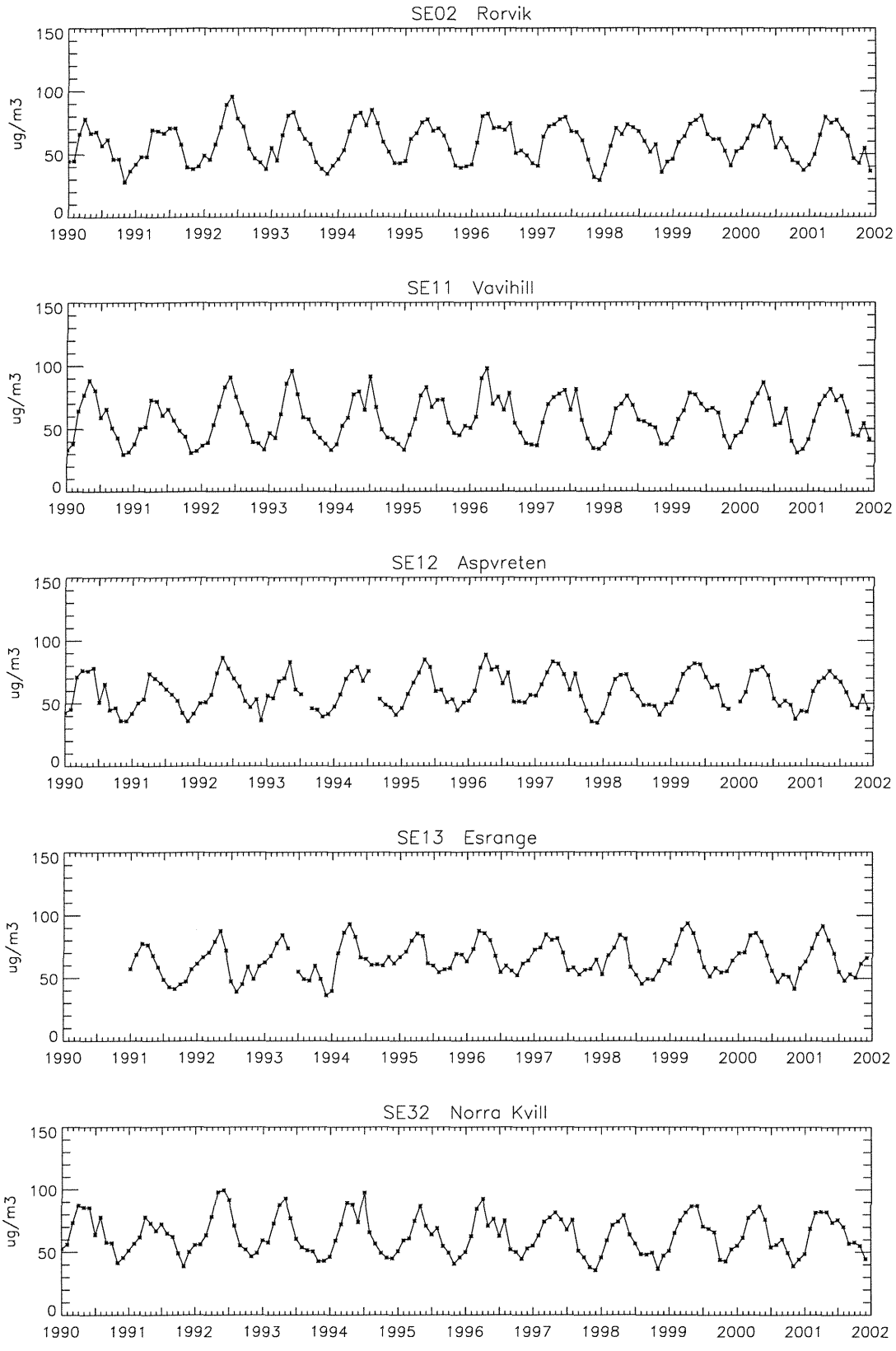


Figure 3.1, cont.

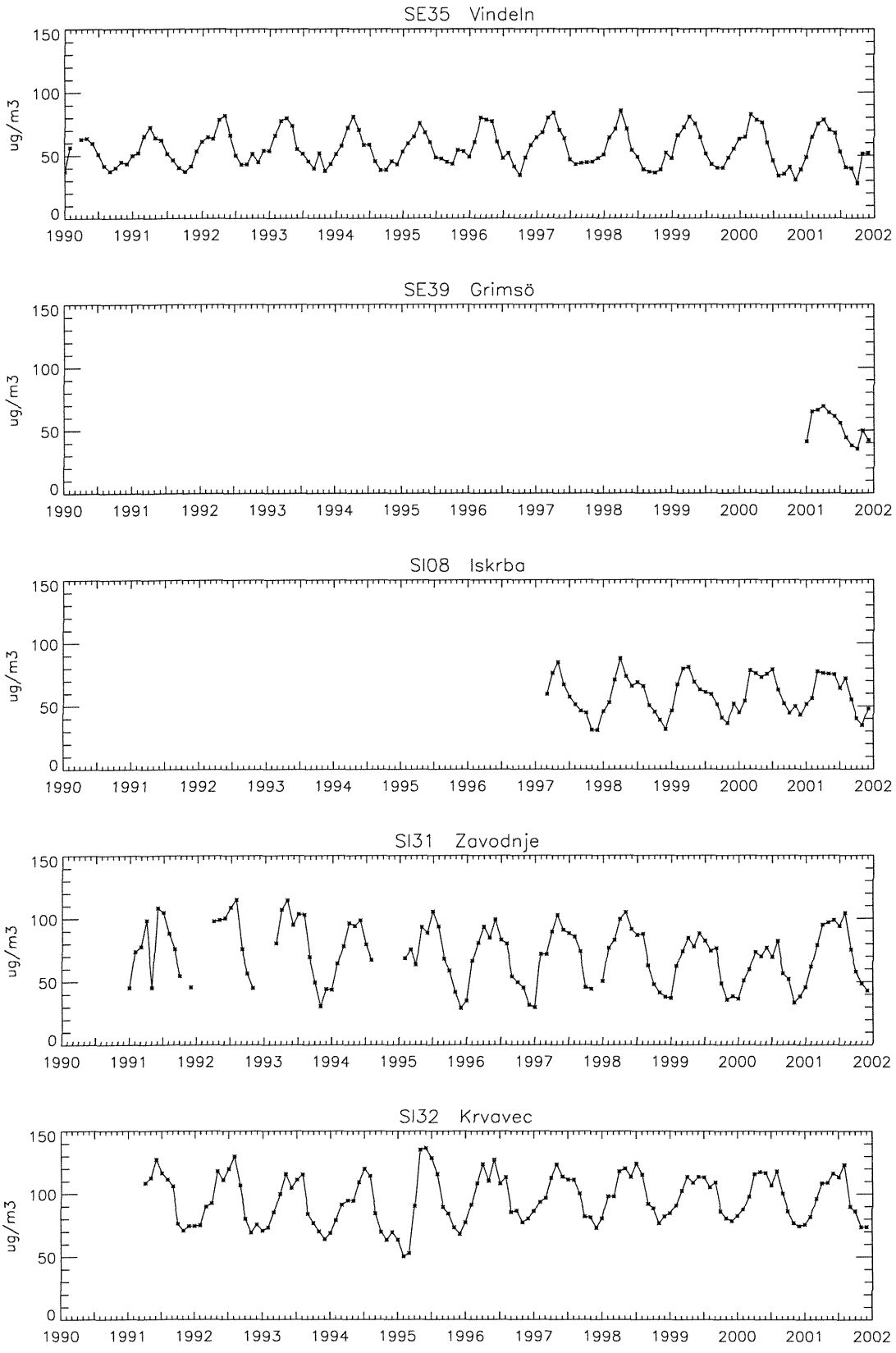


Figure 3.1, cont.

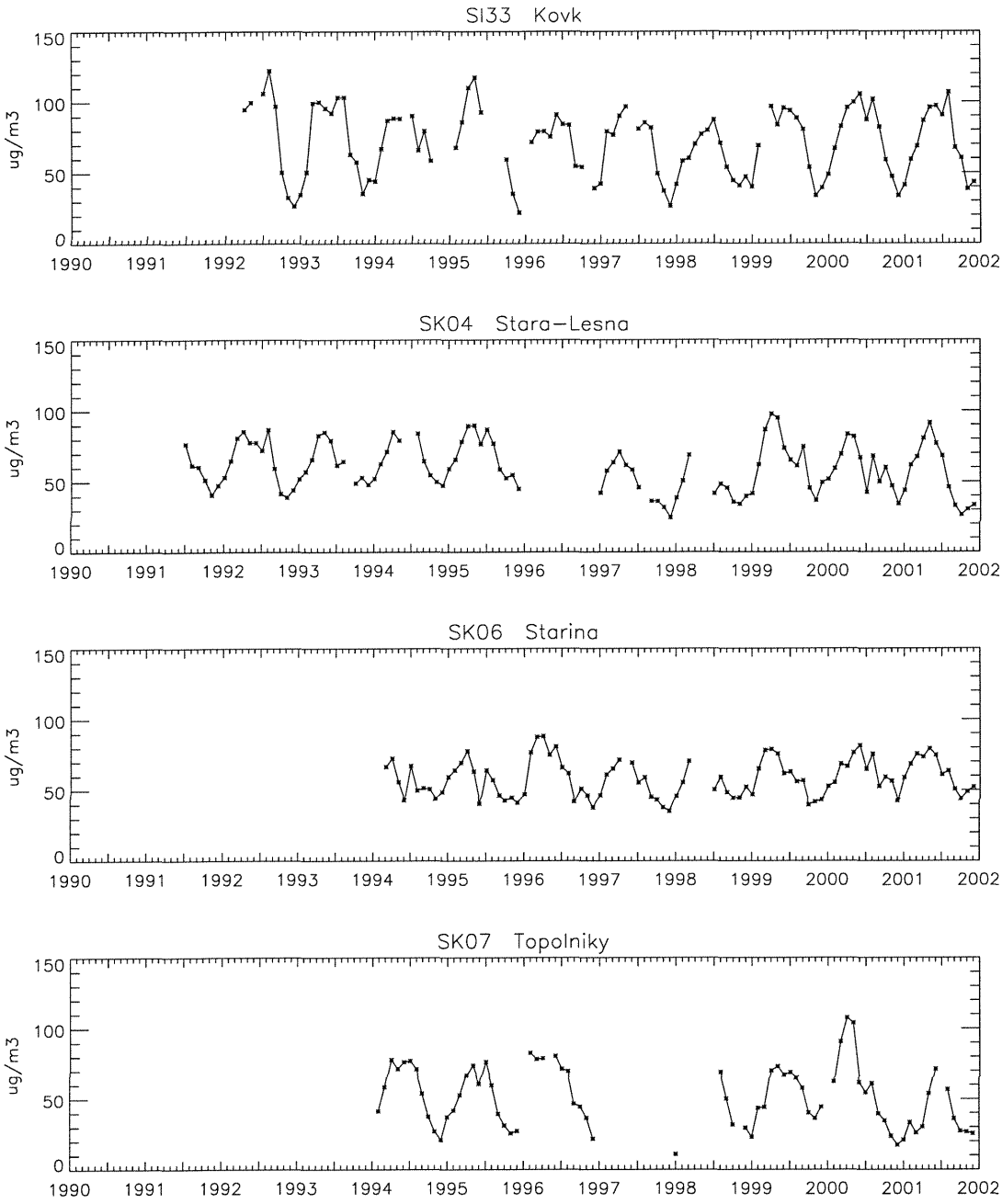


Figure 3.1, cont.

Annex 4

Diurnal variation, April–September 2001

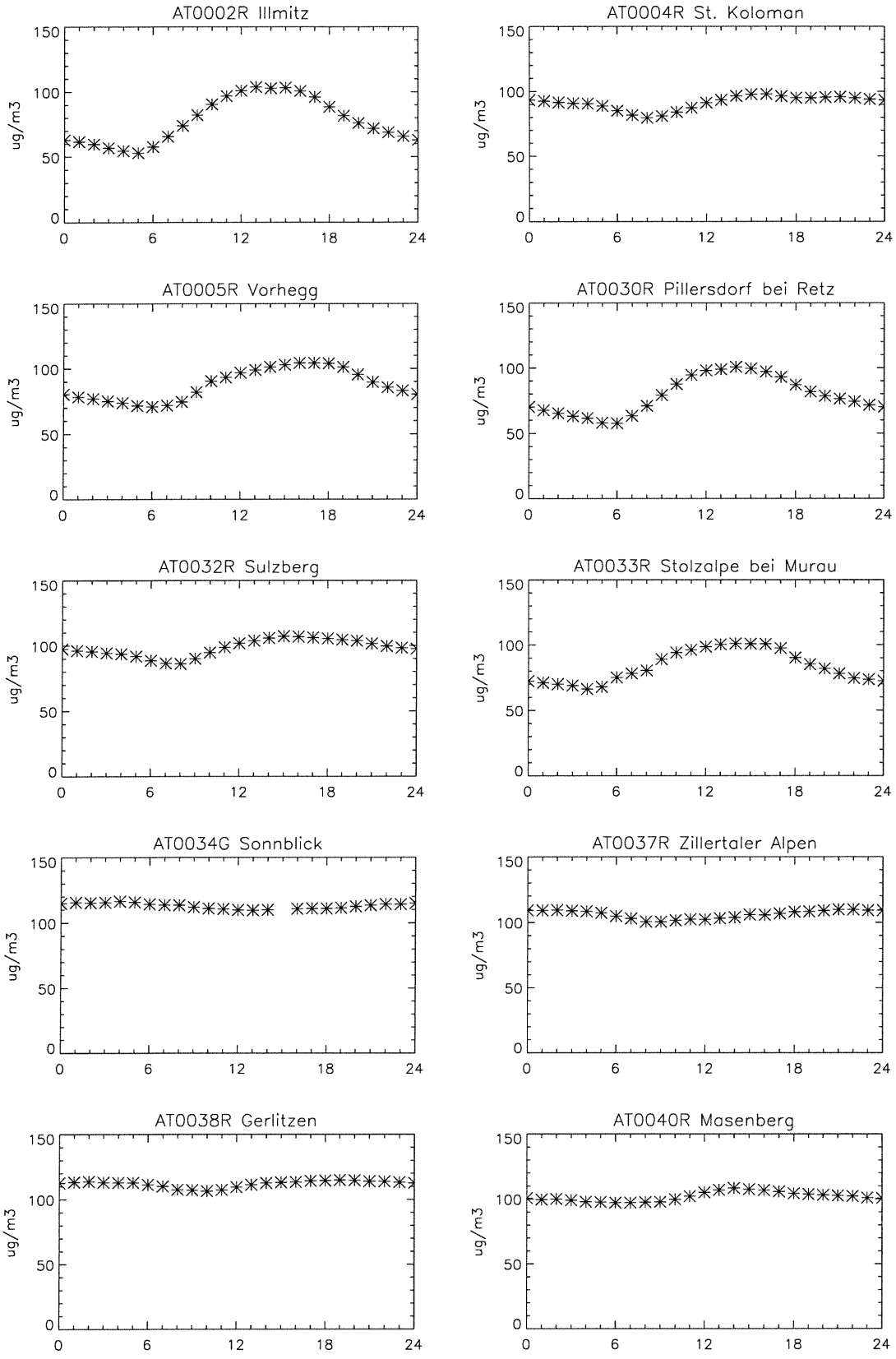


Figure 4.1: Diurnal variation, April–September 2001.

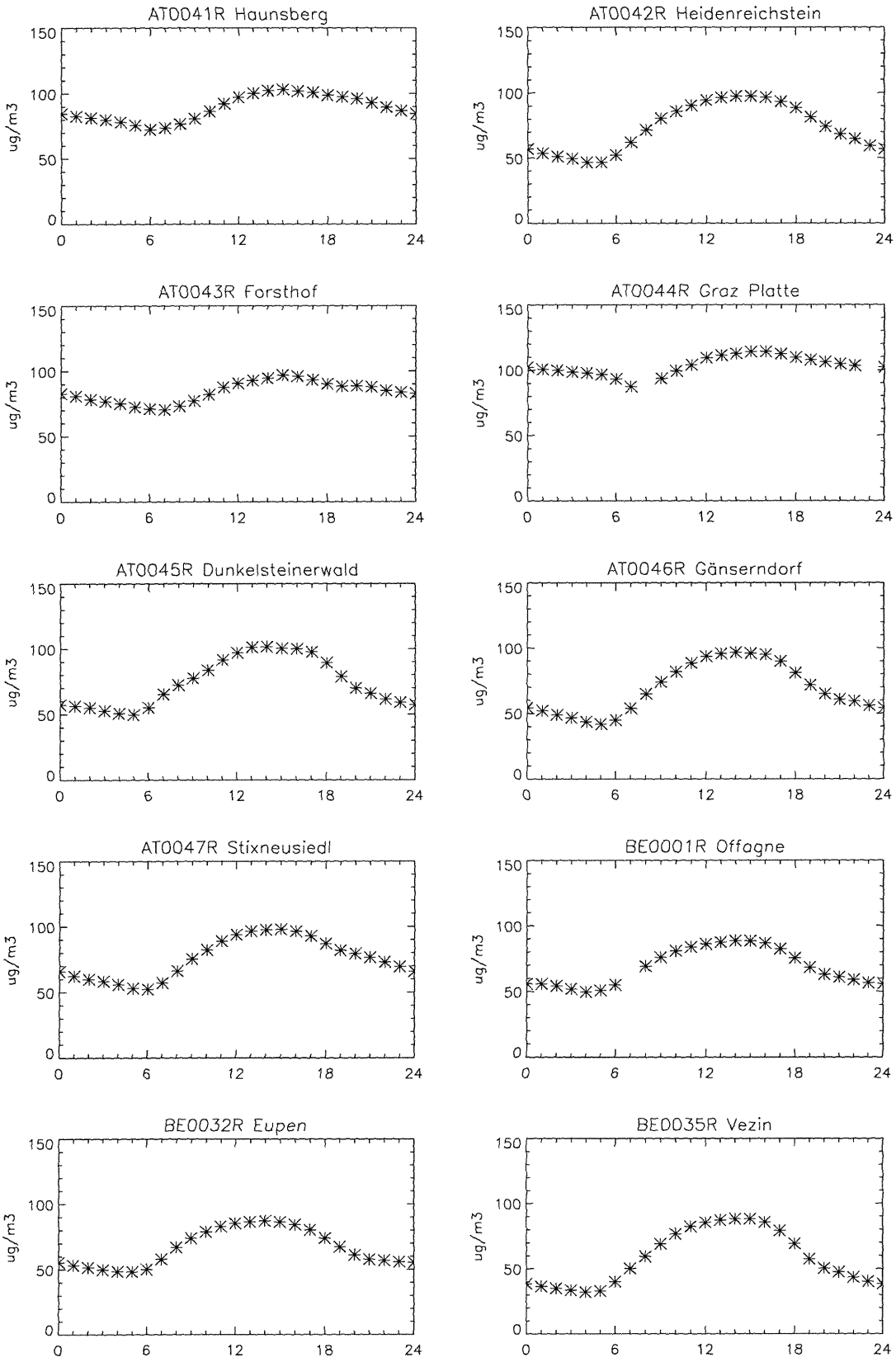


Figure 4.1, cont.

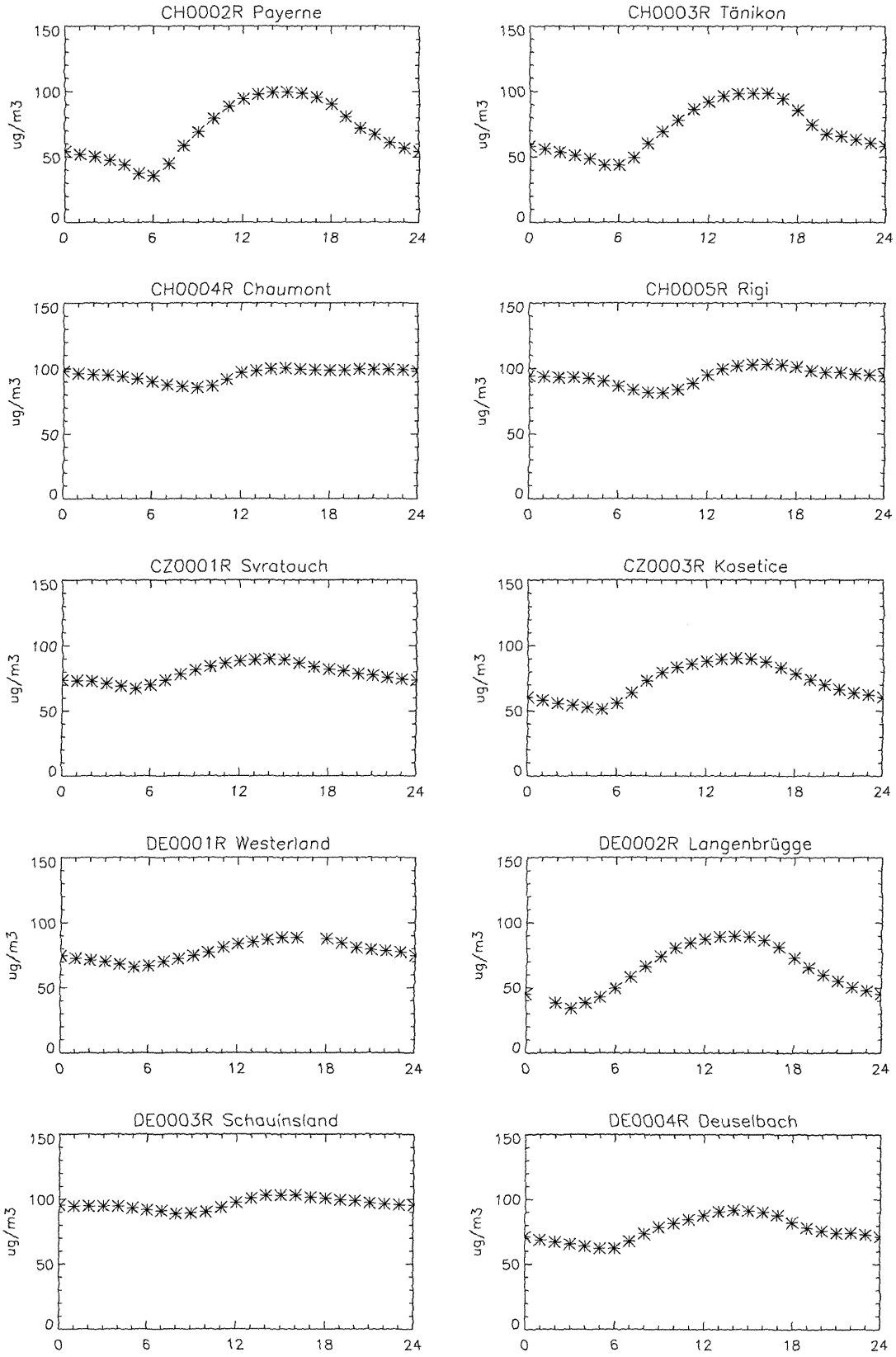


Figure 4.1, cont.

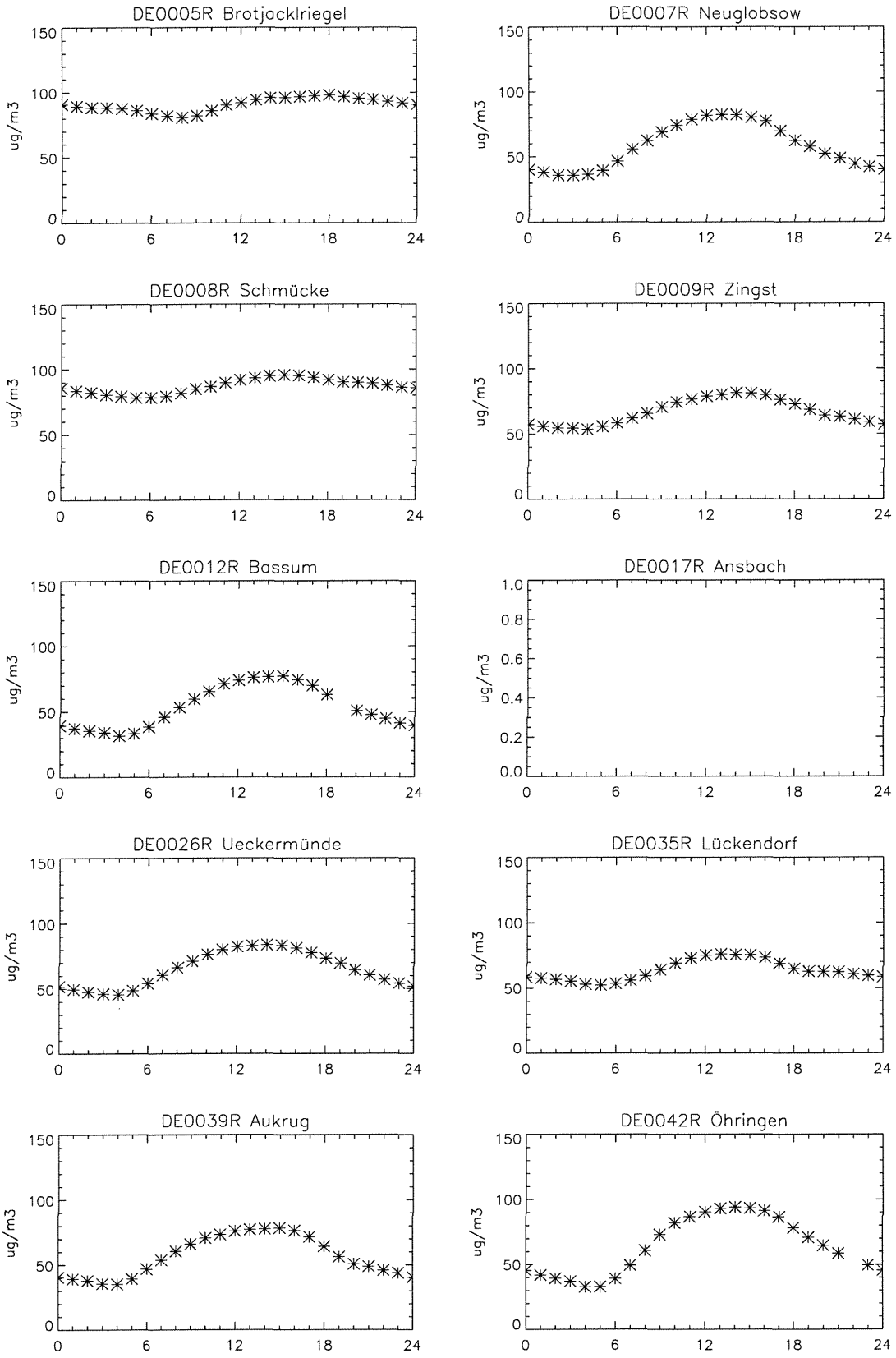


Figure 4.1, cont.

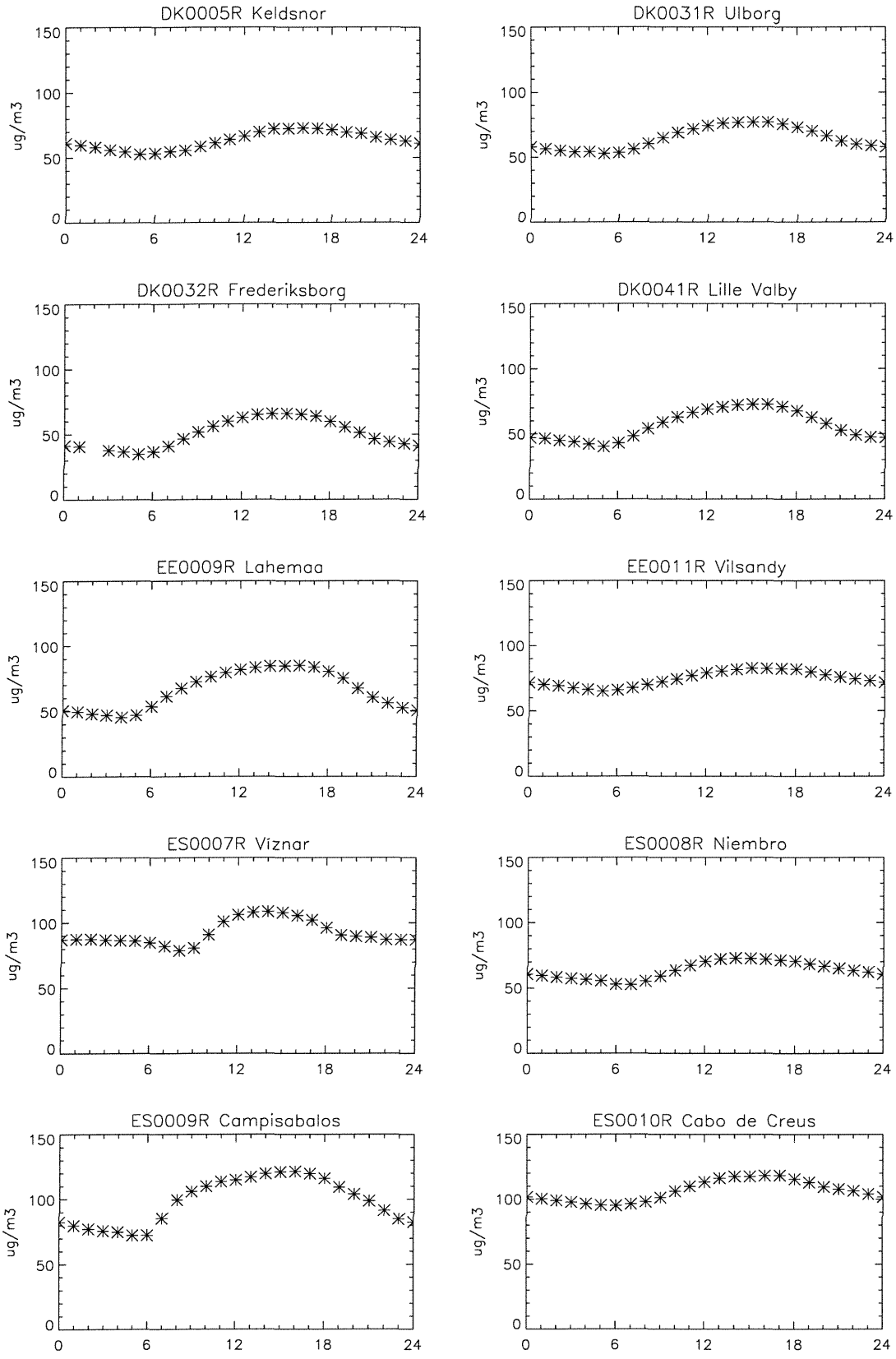


Figure 4.1, cont.

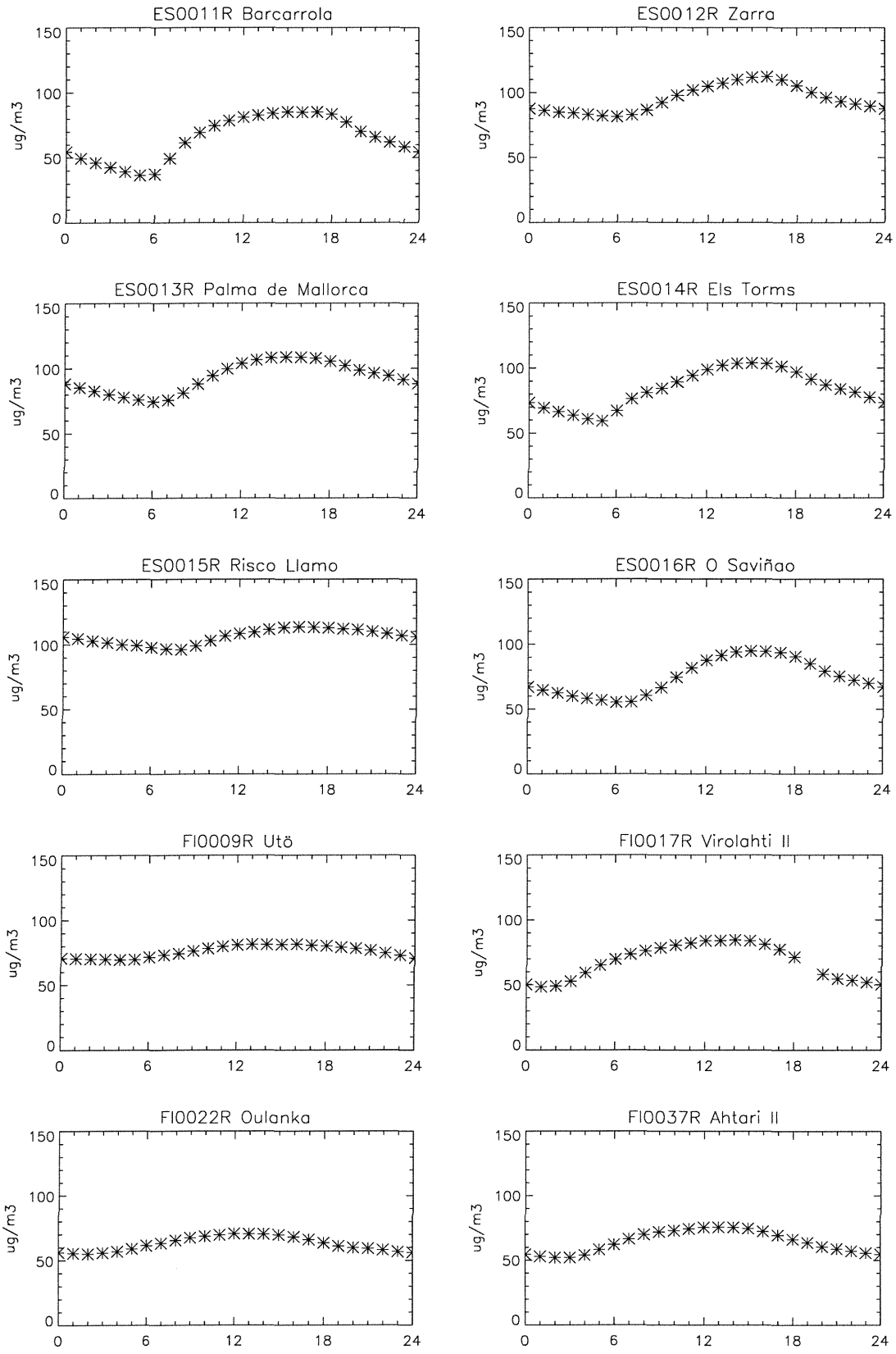


Figure 4.1, cont.

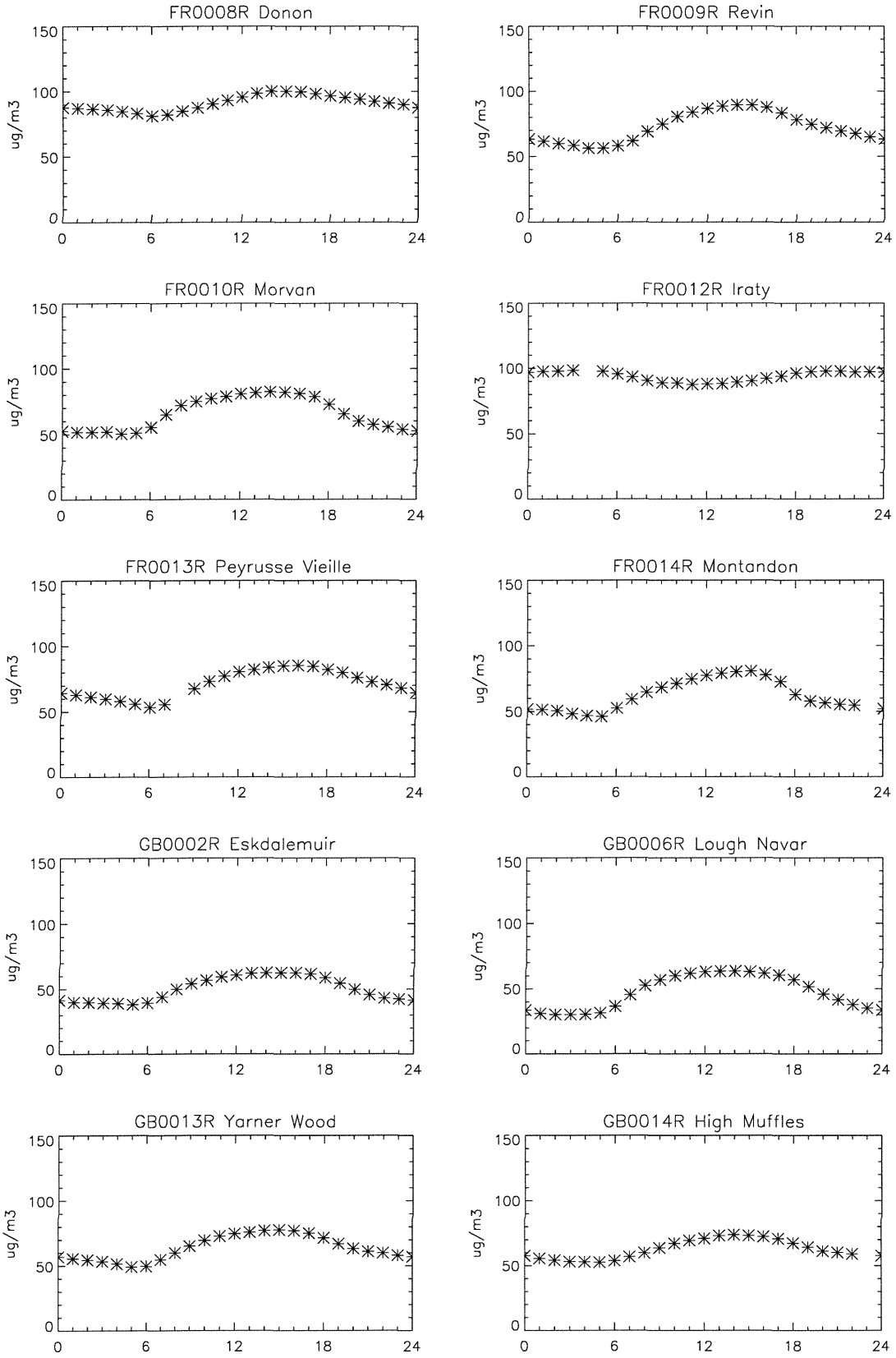


Figure 4.1, cont.

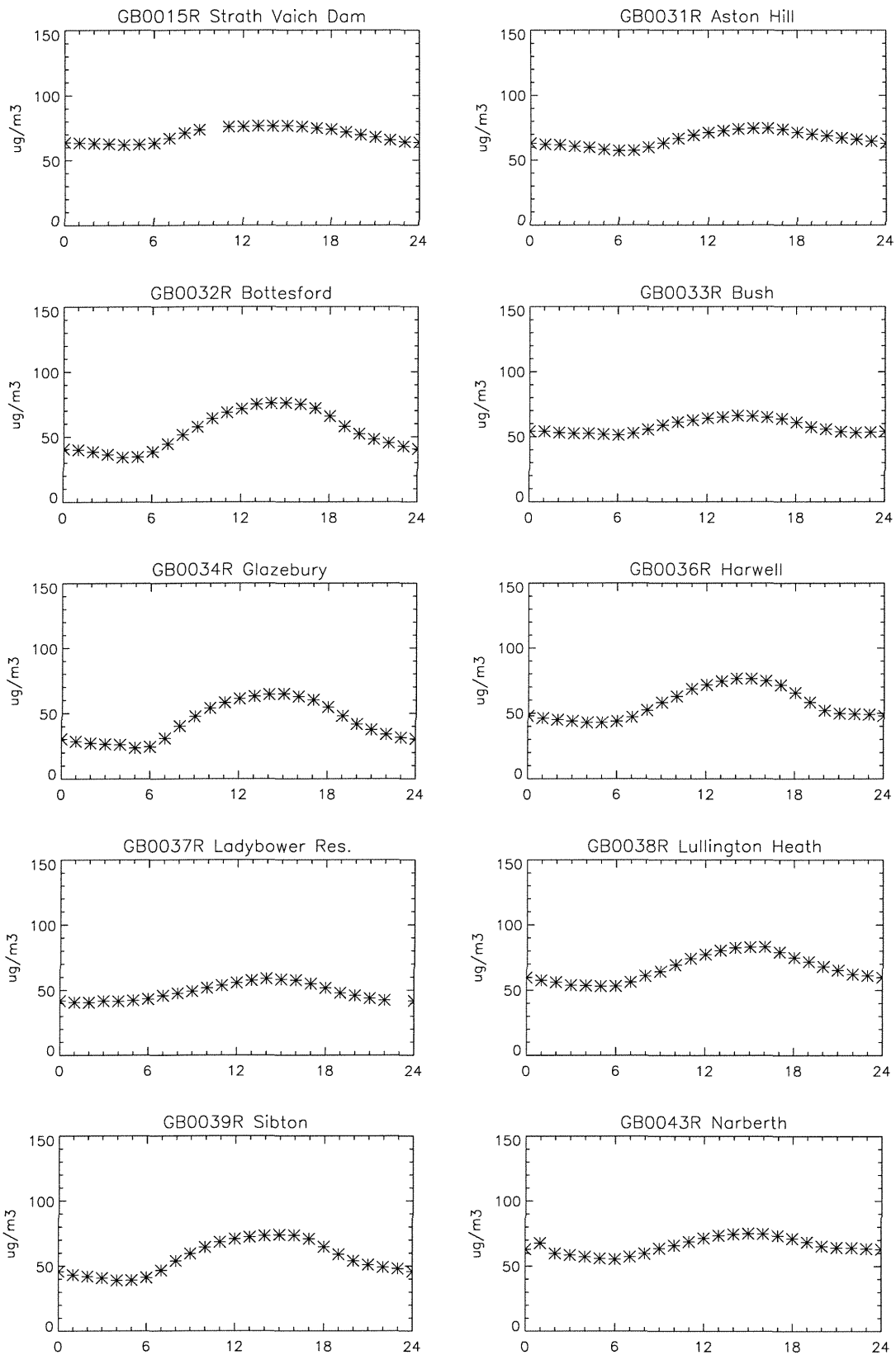


Figure 4.1, cont.

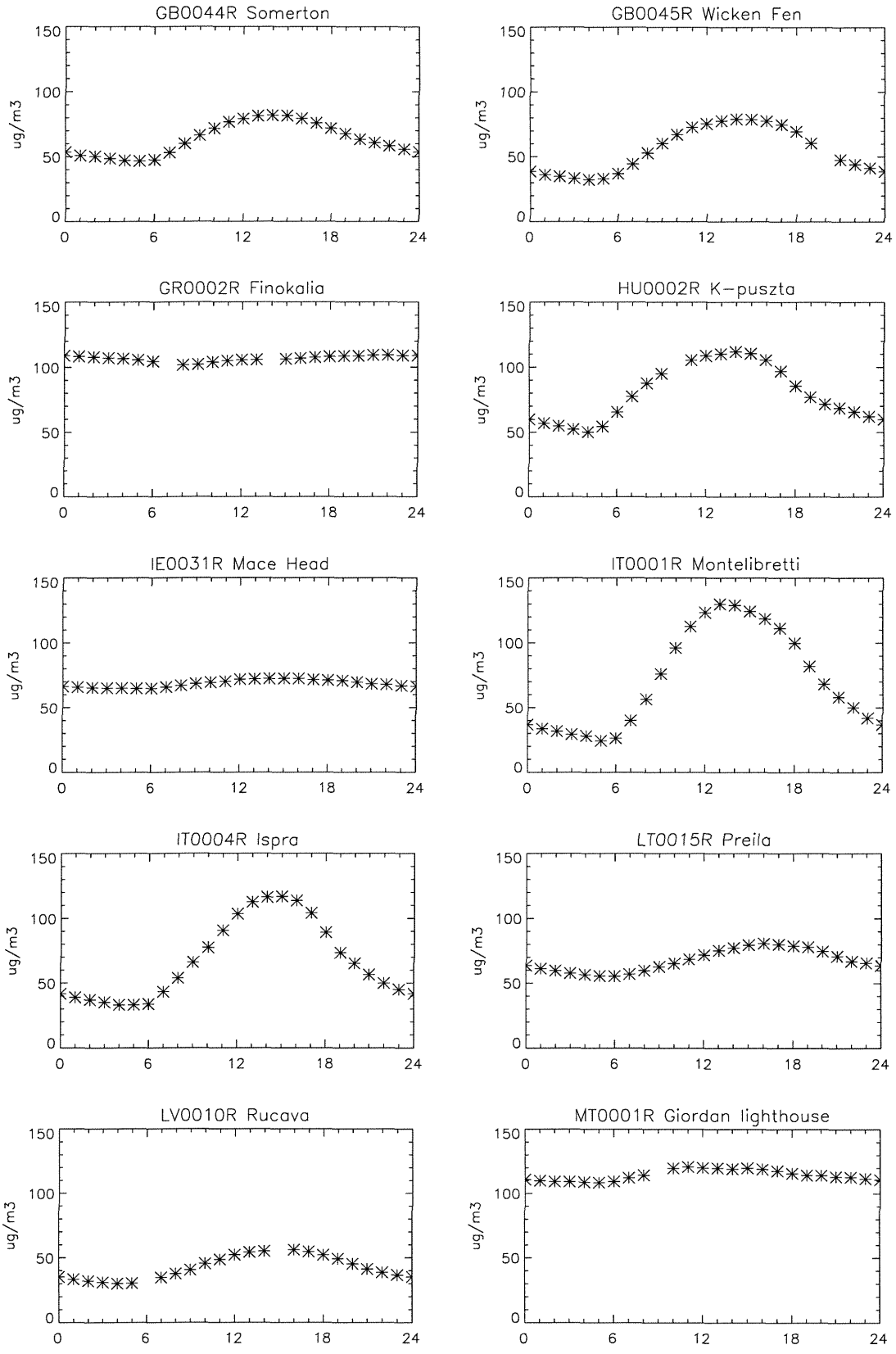
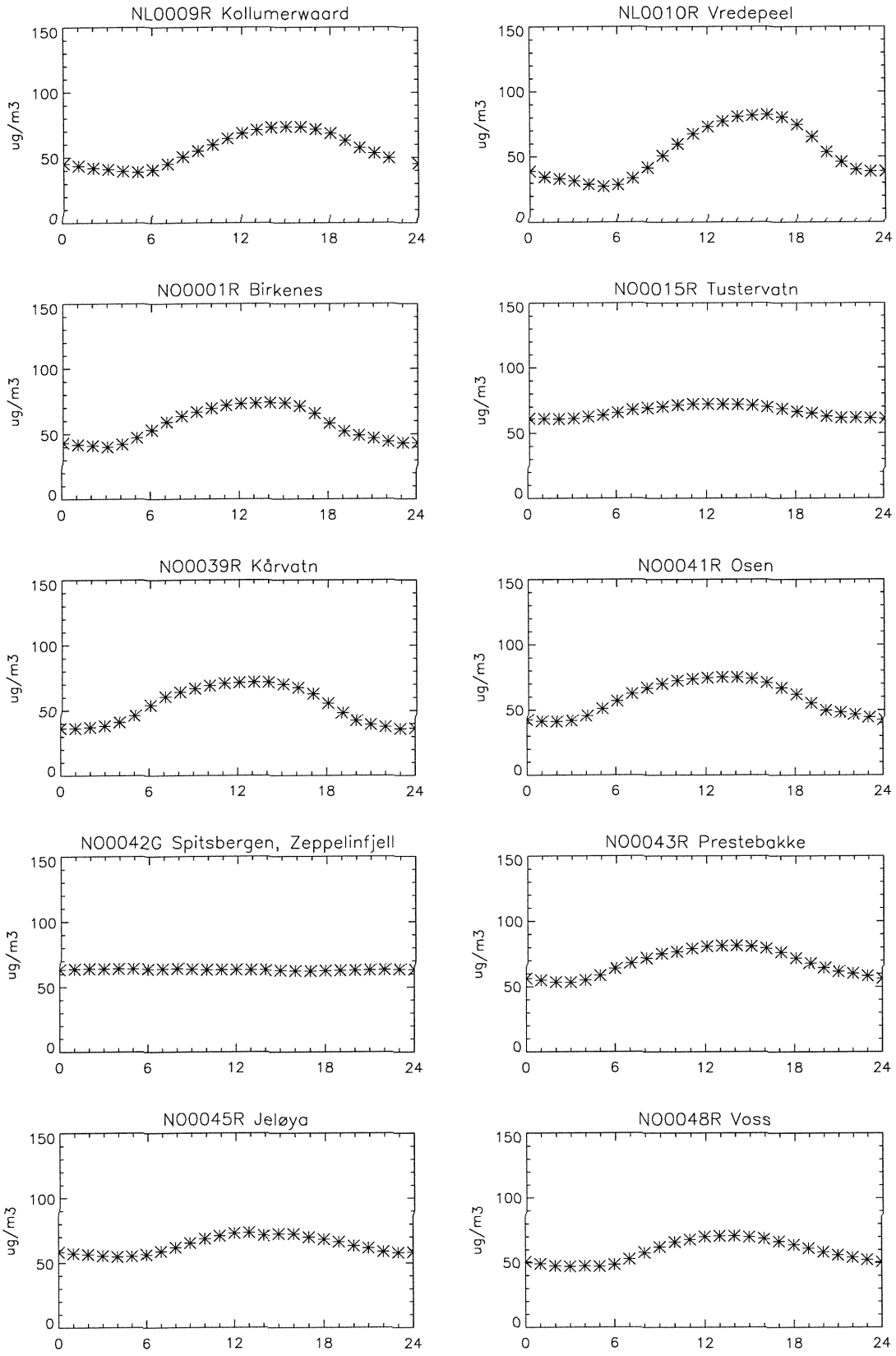


Figure 4.1, cont.



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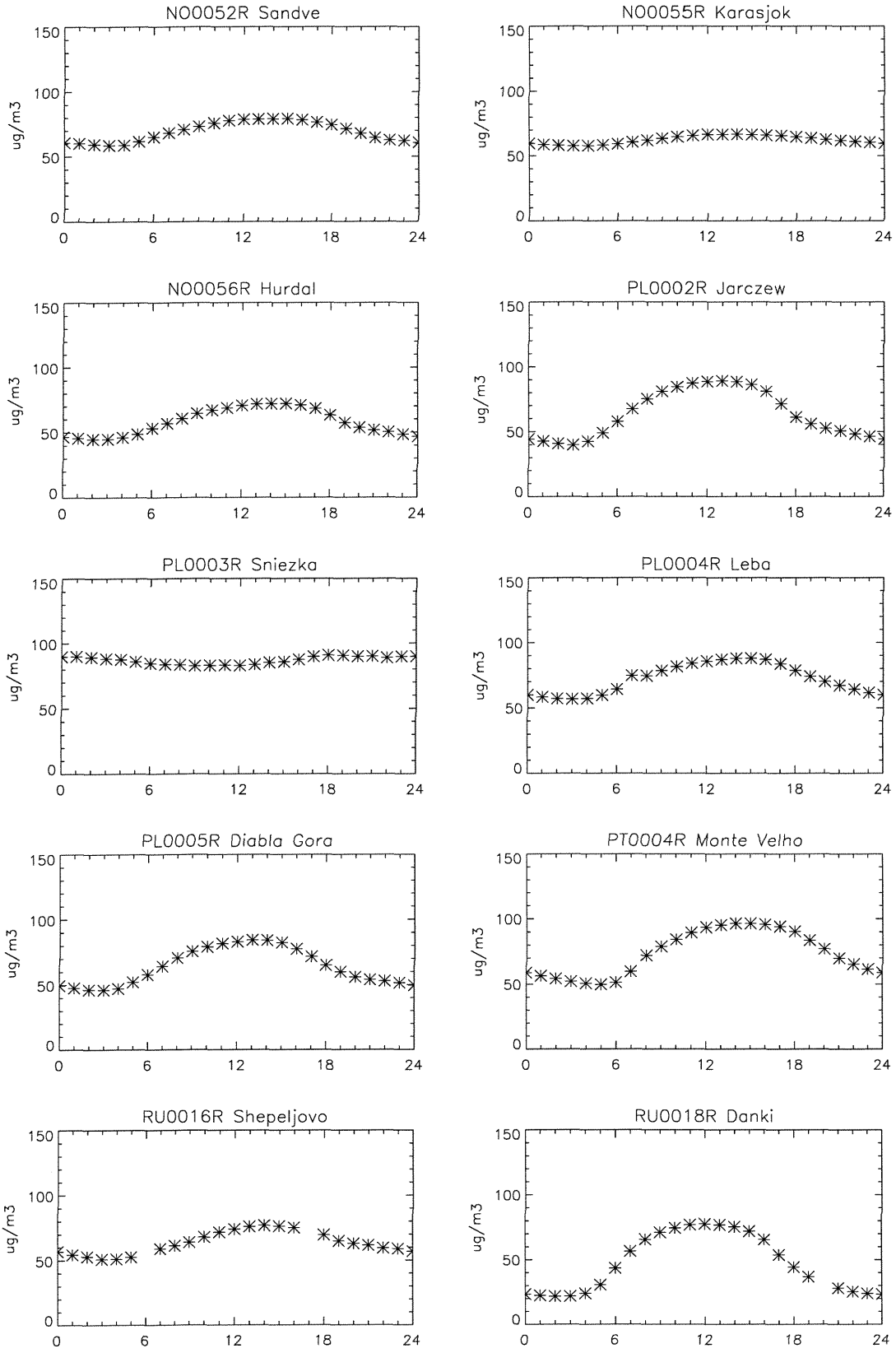

Figure 4.1, cont.

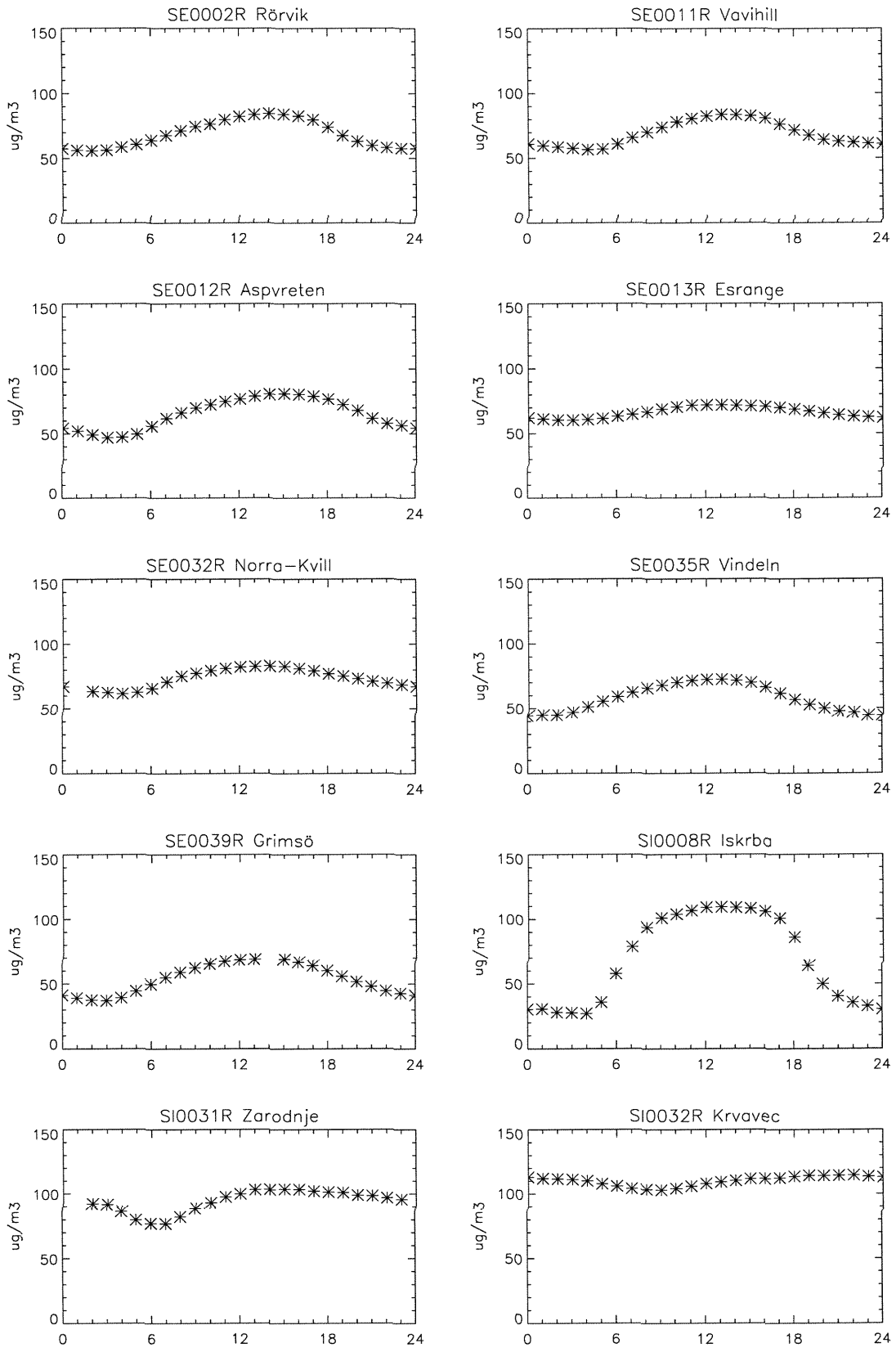

Figure 4.1, cont.

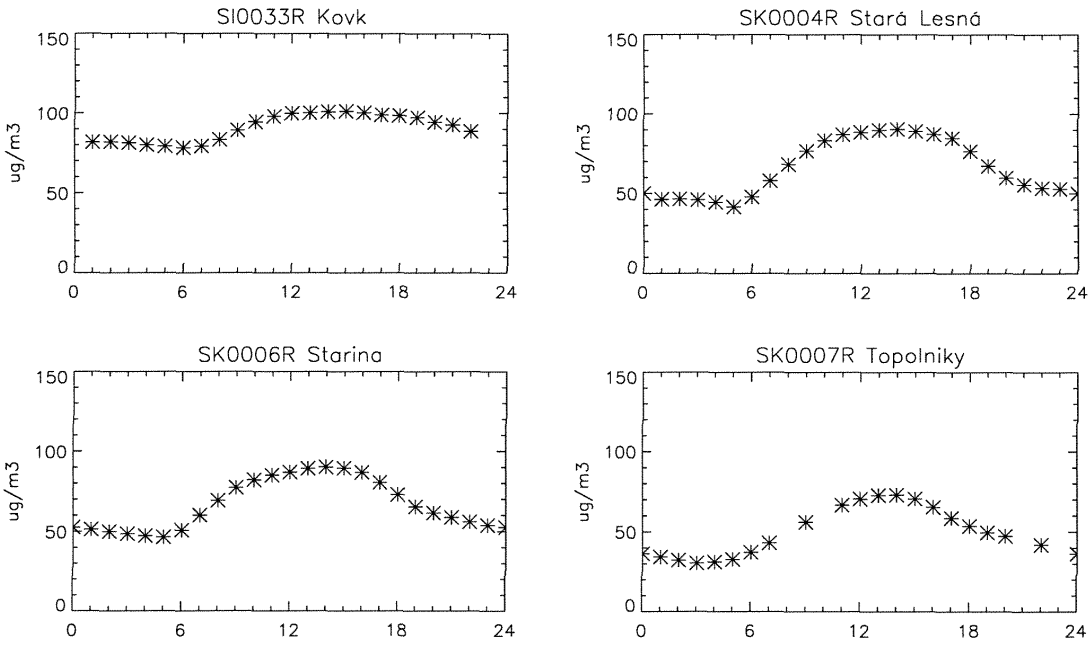

Figure 4.1, cont.

Annex 5

List of data reports

Ozone measurements in the ECE region January 1985–December 1985. Report no. 1.
EMEP/CCC-Report 3/89 by U. Feister and U. Pedersen.
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Kjeller, Norwegian Institute for Air Research, 2003.