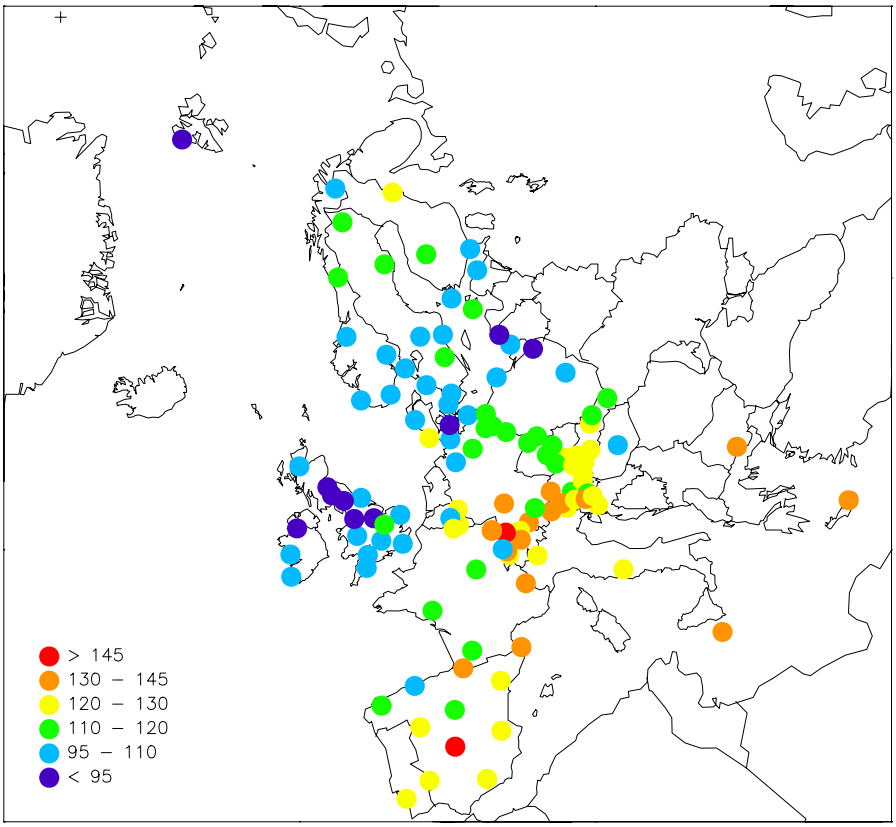
EMEP/CCC-Report 2/2006

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

Ozone measurements 2004

Ann Mari Fjæraa



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Ozone measurements 2004

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 widespread. 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). In EU the ozone directive (Directive 2002/3/EC) has defined a number of target values and

long-term objectives for the protection of vegetation and human health. The target value for human health for 2010 is that 120 g/m^3 (8h mean) is not to be exceeded on more than 25 days per year averaged over 3 years. For protection of vegetation AOT40 (May-July) should not exceed 18,000 g/m^{3}h averaged over five years. In addition information should be given to the population when hourly means exceed 180 µg/m^3 and an alert warning should be issued if hourly means exceed 240 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/m2 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 2004 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 2004. In total 126 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 2004.

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	9 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	5 12 13 E	430
BE0032R	Eupen	Belgium	50 37 46 N	6 00 10 E	295
BE0035R	Vezin	Belgium	50 30 12 N	4 59 22 E	160
BG0053R	Rojen peak	Bulgaria	41 41 45 N	24 44 19 E	1750
CH0002R	Payerne	Switzerland	46 48 47 N	6 56 41 E	489
CH0003R	Tänikon	Switzerland	47 28 47 N	8 54 17 E	539
CH0004R	Chaumont	Switzerland	47 02 59 N	6 58 46 E	1137
CH0005R	Rigi	Switzerland	47 04 03 N	8 27 50 E	1031
CY0002R	Ayia Marina	Cyprus	33 02 21 N	33 03 29 E	532
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	8 18 35 E	12
DE0002R	Langenbrügge	Germany	52 48 08 N	10 45 34 E	74
DE0003R	Schauinsland	Germany	47 54 53 N	7 54 31 E	1205
DE0004R	Deuselbach	Germany	49 45 53 N	7 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	62
DE0009R	Zingst	Germany	54 26 00 N	12 44 00 E	1
DE0012R	Bassum	Germany	52 51 00 N	8 42 00 E	52
DE0026R	Ueckermünde	Germany	53 45 00 N	14 04 00 E	1
DE0035R	Lückendorf	Germany	50 50 00 N	14 46 00 E	490
DE0039R	Aukrug	Germany	54 04 29 N	9 47 34 E	15
DE0042R	Öhringen	Germany	49 14 36 N	9 26 50 E	283
DE0045R	Schorfheide	Germany	52 58 00 N	13 39 00 E	70
DE0046R	Raisting	Germany	47 54 00 N	11 06 00 E	552
DE0047R	Falkenberg	Germany	52 10 00 N	14 07 00 E	73
DK0005R	Keldsnor	Denmark	54 44 00 N	10 44 00 E	10
DK0031R	Ulborg	Denmark	56 17 00 N	8 26 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 00 N	3 32 00 W	1265
ES0008R	Niembro	Spain	43 26 32 N	4 51 01 W	134
ES0009R	Campisabalos	Spain	41 16 52 N	3 08 34 W	1360
ES0010R	Cabo de Creus	Spain	42 19 10 N	3 19 01 E	23
ES0011R	Barcarrola	Spain	38 28 33 N	6 55 22 W	393
ES0012R	Zarra	Spain	39 05 10 N	1 06 07 W	885
ES0013R	Penausende	Spain	41 17 00 N	5 52 00 W	985
ES0014R	Els Torms	Spain	41 24 00 N	0 43 00 E	470
ES0015R	Risco Llamo	Spain	39 31 00 N	4 21 00 W	1241
ES0016R	O Saviñao	Spain	43 13 52 N	7 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	4
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	7 08 00 E	775
FR0009R	Revin	France	49 54 00 N	4 38 00 E	390
FR0010R	Morvan	France	47 16 00 N	4 05 00 E	620
FR0012R	Iraty	France	43 02 00 N	1 05 00 W	1300
FR0013R	Peyrusse Vieille	France	43 37 00 N	0 11 00 E	200
FR0014R	Montandon	France	47 18 00 N	6 50 00 E	836
FR0015R	La Tardière	France	46 39 00 N	0 45 00 W	133
FR0016R	Le Casset	France	45 00 00 N	6 31 00 E	1750
FR0017R	Montfranc	France	46 08 00 N	1 23 00 E	497
GB0002R	Eskdalemuir	United Kingdom	55 18 47 N	3 12 15 W	243
GB0006R	Lough Navar	United Kingdom	54 26 35 N	7 52 12 W	126
GB0013R	Yarner Wood	United Kingdom	50 35 47 N	3 42 47 W	119
GB0014R	High Muffles	United Kingdom	54 20 04 N	0 48 27 W	267
GB0015R	Strath Vaich Dam	United Kingdom	57 44 04 N	4 46 28 W	270
GB0031R	Aston Hill	United Kingdom	52 30 14 N	3 01 59 W	370
GB0032R	Bottesford	United Kingdom	52 55 46 N	0 48 55 W	32
GB0033R	Bush	United Kingdom	55 51 31 N	3 12 18 W	180
GB0034R	Glazebury	United Kingdom	53 27 31 N	2 27 59 W	21
GB0035R	Great Dun Fell	United Kingdom	54 41 00 N	2 27 00 W	847
GB0036R	Harwell	United Kingdom	51 34 23 N	1 19 00 W	137
GB0037R	Ladybower Res.	United Kingdom	53 23 56 N	1 45 12 W	420
GB0038R	Lullington Heath	United Kingdom	50 47 34 N	0 10 46 E	120
GB0039R	Sibton	United Kingdom	52 17 38 N	1 27 47 E	46
GB0044R	Somerton	United Kingdom	51 13 52 N	3 02 53 W	55
GB0045R	Wicken Fen	United Kingdom	52 17 54 N	0 17 34 W	5
GR0001R	Aliartos	Greece	38 22 00 N	23 05 00 E	110
GR0002R	Finokalia	Greece	35 19 00 N	25 40 00 E	0
HU0002R	K-puszta	Hungary	46 58 00 N	19 35 00 E	125
IE0001R	Valentia Observatory	Ireland	51 56 23 N	10 14 40 W	11
IE0031R	Mace Head	Ireland	53 10 00 N	9 30 00 W	15
IT0001R	Montelibretti	Italy	42 06 00 N	12 38 00 E	48
IT0004R	Ispra	Italy	45 48 00 N	8 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
NO0001R	Birkenes	Norway	58 23 00 N	8 15 00 E	190
NO0015R	Tustervatn	Norway	65 50 00 N	13 55 00 E	439
NO0039R	Kårvatn	Norway	62 47 00 N	8 53 00 E	210
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
NO0052R	Sandve	Norway	59 12 00 N	5 12 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	8 48 00 W	43
SE0005R	Bredkälen	Sweden	63 51 00 N	15 20 00 E	404
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
SE0014R	Råö	Sweden	57 23 38 N	11 54 50 E	5

Table 1, cont.

Code	Station	Country	Latitude	Longitude	Altitude (m)
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	59 43 40 N	15 28 19 E	132
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
SK0002R	Chopok	Slovakia	48 56 00 N	19 35 00 E	2008
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

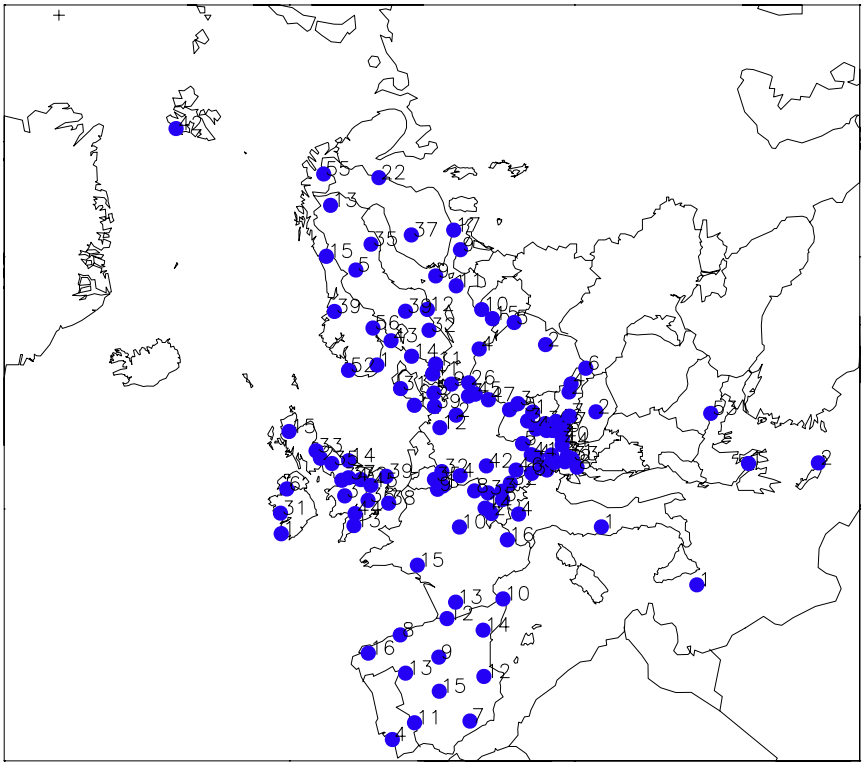

Figure 1: Location of the monitoring stations.

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 concentrations reported for the Greek station GR0001 Aliartos showed very much lower concentrations during the whole year compared to other EMEP sites. Furthermore, monitoring of NO_2 at the site revealed monthly mean concentrations of NO_2 of the order of XX to YY $\mu g/m^3$. These findings indicate

that the site is significantly influenced by nearby anthropogenic emissions, presumably from the Athens region, and thus not well suited as a regional background site for surface ozone. The ozone data from GR0001 is therefore not included in the report.

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 2004.

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
Cyprus	
Czech Republic	2.0
Denmark	2.0
Estonia	2.14
Finland	2.0
France	2.0
Germany	2.0
Greece (Aliartos)	1.96
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 2004 100 stations had a capture above 90%. Nine sites were below 75%.

Table 3: Data capture in per cent, 2004.

Code	Station	Data capture 2004
AT0002R	Illmitz	90.3
AT0004R	St. Koloman	22.2
AT0005R	Vorhegg	94.9
AT0030R	Pillersdorf bei Retz	91.4
AT0032R	Sulzberg	95.9
AT0033R	Stolzalpe bei Murau	91.8
AT0034G	Sonnblick	91.5
AT0037R	Zillertaler Alpen	95.7
AT0038R	Gerlitzen	95.8
AT0040R	Masenberg	95.3
AT0041R	Haunsberg	93.2
AT0042R	Heidenreichstein	91.3
AT0043R	Forsthof	91.4
AT0044R	Graz Platte	89.6
AT0045R	Dunkelsteinerwald	69.6
AT0046R	Gänserndorf	94.7
AT0047R	Stixneusiedl	90.3
BE0001R	Offagne	90.2
BE0032R	Eupen	86.3
BE0035R	Vezin	88.4
BG0053R	Rojen peak	98.8
CH0002R	Payerne	94.1
CH0003R	Tänikon	95.4
CH0004R	Chaumont	95.3
CH0005R	Rigi	94.5
CY0002R	Ayia Marina	90.9
CZ0001R	Svratouch	97.7
CZ0003R	Kosetice	96.3
DE0001R	Westerland	95.7
DE0002R	Langenbrügge	89.3
DE0003R	Schauinsland	94.7
DE0004R	Deuselbach	56.2
DE0005R	Brotjacklriegel	56.3
DE0007R	Neuglobsow	90.8
DE0009R	Zingst	95.8
DE0012R	Bassum	86.1
DE0026R	Ueckermünde	95.9
DE0035R	Lückendorf	91.4
DE0039R	Aukrug	90.9
DE0042R	Öhringen	87.5
DE0045R	Schorfheide	89.3
DE0046R	Raisting	70.3
DE0047R	Falkenberg	93.2

Table 3, cont.

Code	Station	Data capture 2004
DK0005R	Keldsnor	83.1
DK0031R	Ulborg	87.5
DK0041R	Lille Valby	97.0
EE0009R	Lahemaa	98.9
EE0011R	Vilsandy	97.7
ES0007R	Víznar	98.1
ES0008R	Niembro	97.5
ES0009R	Campisabalos	94.7
ES0010R	Cabo de Creus	94.2
ES0011R	Barcarrola	94.4
ES0012R	Zarra	94.4
ES0013R	Penausende	97.6
ES0014R	Els Torms	97.5
ES0015R	Risco Llamo	96.2
ES0016R	O Saviñao	96.7
FI0009R	Utö	90.0
FI0017R	Virolahti II	98.2
FI0022R	Oulanka	92.2
FI0037R	Ahtari II	99.0
FR0008R	Donon A	96.6
FR0008R	Donon B	96.6
FR0008R	Donon C	98.0
FR0008R	Donon D	97.9
FR0009R	Revin	96.6
FR0010R	Morvan	95.6
FR0012R	Iraty	85.5
FR0013R	Peyrusse Vieille	96.3
FR0014R	Montandon	93.3
FR0015R	La Tardière	99.5
FR0016R	Le Casset	98.3
FR0017R	Montfranc	98.2
GB0002R	Eskdalemuir	90.5
GB0006R	Lough Navar	74.8
GB0013R	Yarner Wood	97.5
GB0014R	High Muffles	99.2
GB0015R	Strath Vaich Dam	83.9
GB0031R	Aston Hill	89.4
GB0032R	Bottesford	98.7
GB0033R	Bush	98.4
GB0034R	Glazebury	95.9
GB0035R	Great Dun Fell	99.0
GB0036R	Harwell	90.2
GB0037R	Ladybower Res.	85.1
GB0038R	Lullington Heath	95.6
GB0039R	Sibton	96.3
GB0044R	Somerton	95.6
GB0045R	Wicken Fen	93.2
GR0001R	Aliartos	99.7
GR0002R	Finokalia	76.1
HU0002R	K-puszta	88.9
IE0001R	Valentia Observatory	72.8
IE0031R	Mace Head	98.3

Table 3, cont.

Code	Station	Data capture 2004
IT0001R	Montelibretti	97.9
IT0004R	Ispra	81.3
LT0015R	Preila	94.8
LV0010R	Rucava	91.9
MT0001R	Giordan Igthouse	89.0
NO0001R	Birkenes	98.4
NO0015R	Tustervatn	99.1
NO0039R	Kårvatn	99.6
NO0042G	Spitsbergen, Zeppelinfjell	99.4
NO0043R	Prestebakke	99.6
NO0052R	Sandve	98.6
NO0055R	Karasjok	99.5
NO0056R	Hurdal	99.7
PL0002R	Jarczew	99.5
PL0003R	Sniezka	99.9
PL0004R	Leba	99.9
PL0005R	Diabla Gora	97.7
PT0004R	Monte Velho	62.0
SE0005R	Bredkälen	58.1
SE0011R	Vavihill	99.2
SE0012R	Aspvreten	95.5
SE0013R	Esrange	99.9
SE0014R	Råö	99.8
SE0032R	Norra-Kvill	99.1
SE0035R	Vindeln	99.6
SE0039R	Grimsö	98.1
SI0008R	Iskrba	94.4
SI0031R	Zarodnje	95.1
SI0032R	Krvavec	99.0
SI0033R	Kovk	86.8
SK0002R	Chopok	89.9
SK0004R	Stará Lesná	98.5
SK0006R	Starina	83.0
SK0007R	Topolniky	98.2

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 2004. 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 were found at K-puszta, Hungary (253 µg/m^3, 12th September), Krvavec, Slovenia (218 µg/m^3, 10th June) and in Sibton in Great Britain (212 µg/m^3, 8th August).

Values above 200 µg/m^3 were during 2004 measured at six sites in Central Europe, compared to 44 sites in 2003 and seven sites in 2002. The lowest maximum values were observed at Spitsbergen, Norway (109.7 µg/m^3, 26th April).

The one hour critical level for ozone formulated by the ECE for protection of vegetation, 150 µg/m^3, was in 2004 exceeded at 88 sites in Central and Southern Europe (Figure 1.3, Annex 1). At six sites the limit was exceeded 25 days or more.

Figure 1.4 (in Annex 1) shows the number of exceedances of the threshold value of 180 µg/m^3 formulated by the EU for informing the public. At Montelibretti, the threshold value was exceeded eight days, while five additional sites measured above 180 µg/m^3 for at least four days. In total values above 180 µg/m3 were measured at 33 sites.

Table 1.2 in Annex 1 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 (in Annex 1).

The lowest values are found in the Northern parts of Central Europe, Baltics, Ireland, Scotland and Scandinavia, where the 99-percentile is below 140 µg/m^3. The concentrations are higher in Central Europe, where the 99-percentile generally ranges from 140-160 µg/m^3. A few sites in Central Europe had values above 160 µg/m^3. The concentration levels on the Iberian Peninsula are variable, 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 2004 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 and from north to south. The lowest values are found in Scandinavia, in the Baltic region and in Ireland and the United

Kingdom, while the highest values are found in Austria, Hungary, Slovenia and in France.

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 Europe. Several stations in Central Europe, France and Spain had AOT40 values above 25 000 ppbh. The critical level for agricultural crops, 3000 ppbh, was in 2004 exceeded at most stations in Central Europe, Scandinavia, on Malta and in Greece.

7. Seasonal variation

Monthly mean concentrations for 2004 are given in Table 3.1 in Annex 3 and monthly data capture in Table 3.2 (Annex 3). 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 1990-2004 are given in Figure 3.1 (Annex 3).

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) 2004 is shown in Figure 4.1 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 Austrian and German sites, the Slovenian site Iskrba 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 2 June, 2006.

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
Bulgaria	Executive Environment Agency
Commission of the European Communities	Joint Research Center. Ispra Establishment
Cyprus	Ministry of Labour and Social Insurance
Czech Republic	Czech Hydrometeorological Institute
Denmark	National Environmental Research Institute (DMI)
Estonia	Estonian Environmental Research Laboratory Ltd.
Finland	Finnish Meteorological Institute (FMI)
France	l' Ecole des Mines de Douai Laboratories Wolff
Germany	Umweltbundesamt
Greece	Environmental Chemical Processes Laboratory, University of Crete Ministry of Environmental Physical Planning and Public Works
Hungary	Meteorological Service, Institute for Atmospheric Physics, Dep. for Air Chemistry
Italy	C.N.R. Istituto Inquinamento Atmosferico
Latvia	Latvian Environment, Geology and Meteorology Agency
Lithuania	Environmental Physics and Chemistry Laboratory, Institute of Physics
Malta	University of Malta
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	Instituto de Meteorologica
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/m^3 and maximum concentrations in 2004.

Code	Station	Total		>120		>150		>180		>200		Max concentrations	
		hours	days	hours	days	hours	days	hours	days	hours	days	μg/m^3	day(s)
AT0002R	Illmitz	7929	350	297	58	28	8	0	0	0	0	175	09.06.2004
AT0004R	St. Koloman	1946	82	17	2	0	0	0	0	0	0	130	12.03.2004
AT0005R	Vorhegg	8337	366	282	48	32	7	2	1	0	0	197	10.06.2004
AT0030R	Pillersdorf bei Retz	8025	355	325	58	23	7	2	1	0	0	196	12.08.2004
AT0032R	Sulzberg	8422	366	741	80	102	12	1	1	0	0	181	31.07.2004
AT0033R	Stolzalpe bei Murau	8066	355	116	24	1	1	0	0	0	0	151	21.05.2004
AT0034G	Sonnblick	8038	353	977	104	22	8	0	0	0	0	160	31.07.2004
AT0037R	Zillertaler Alpen	8405	366	550	57	33	7	0	0	0	0	167	31.07.2004
AT0038R	Gerlitzen	8417	366	502	67	18	6	0	0	0	0	161	11.06.2004
AT0040R	Masenberg	8375	366	441	61	10	3	0	0	0	0	157	20.05.2004
AT0041R	Haunsberg	8191	362	403	56	43	12	0	0	0	0	178	01.08.2004
AT0042R	Heidenreichstein	8017	354	158	33	12	3	1	1	0	0	184	12.08.2004
AT0043R	Forsthof	8030	355	349	51	12	5	1	1	0	0	192	19.08.2004
AT0044R	Graz Platte	7871	349	472	57	14	3	0	0	0	0	165	20.05.2004
AT0045R	Dunkelsteinerwald	6113	279	171	36	14	5	0	0	0	0	177	05.08.2004
AT0046R	Gänserndorf	8318	365	241	58	18	7	0	0	0	0	163	18.08.2004
AT0047R	Stixneusiedl	7932	349	243	50	23	9	0	0	0	0	176	09.06.2004
BE0001R	Offagne	7920	360	246	38	28	6	0	0	0	0	174	30.07.2004
BE0032R	Eupen	7583	347	232	35	59	13	5	2	0	0	191	30.07.2004
BE0035R	Vezin	7761	358	77	14	23	5	0	0	0	0	174	03.08.2004, 05.08.2004
BG0053R	Rojen peak	8678	366	740	106	8	4	0	0	0	0	160	18.08.2004
CH0002R	Payerne	8267	363	305	61	36	7	1	1	0	0	180	31.07.2004
CH0003R	Tänikon	8382	366	349	66	71	18	8	4	0	0	189	30.07.2004
CH0004R	Chaumont	8374	366	783	77	112	10	20	4	0	0	194	31.07.2004
CH0005R	Rigi	8297	365	746	79	125	18	12	4	0	0	187	31.07.2004
CY0002R	Ayia Marina	7983	365	984	125	3	3	0	0	0	0	157	19.09.2004
CZ0001R	Svratouch	8585	365	141	24	0	0	0	0	0	0	150	09.06.2004
CZ0003R	Košetice	8462	362	178	34	6	3	0	0	0	0	157	12.08.2004
DE0001R	Westerland	8410	366	227	38	14	5	0	0	0	0	172	30.05.2004
DE0002R	Langenbrügge	7848	346	180	30	5	3	0	0	0	0	157	31.07.2004
DE0003R	Schauinsland	8315	364	946	74	236	26	71	7	9	4	211	31.07.2004
DE0004R	Deuselbach	4940	215	160	23	28	4	3	1	0	0	188	30.07.2004
DE0005R	Brotjacklriegel	4946	212	425	47	27	5	0	0	0	0	169	09.06.2004
DE0007R	Neuglobsow	7979	365	112	25	7	3	0	0	0	0	163	12.08.2004

Table 1.1, cont.

Code	Station	Total		>120		>150		>180		>200		Max concentrations	
		hours	days	hours	days	hours	days	hours	days	hours	days	$\mu g/m^3$	day(s)
DE0009R	Zingst	8416	366	22	6	0	0	0	0	0	0	130	01.05.2004
DE0012R	Bassum	7563	347	82	20	2	1	0	0	0	0	151	09.08.2004
DE0026R	Ueckermünde	8425	366	99	20	2	1	0	0	0	0	153	30.04.2004
DE0035R	Lückendorf	8029	361	195	31	12	4	0	0	0	0	157	12.08.2004
DE0039R	Aukrug	7983	349	75	15	2	1	0	0	0	0	151	04.09.2004
DE0042R	Öhringen	7685	336	343	54	70	17	0	0	0	0	180	09.06.2004
DE0045R	Schorfheide	7844	360	140	31	3	1	1	1	0	0	188	12.08.2004
DE0046R	Raisting	6174	280	169	36	22	7	0	0	0	0	169	05.08.2004
DE0047R	Falkenberg	8184	359	158	34	7	2	0	0	0	0	180	12.08.2004
DK0005R	Keldsnor	7297	310	0	0	0	0	0	0	0	0	118	08.08.2004
DK0031R	Ulborg	7684	328	68	14	0	0	0	0	0	0	139	30.04.2004
DK0041R	Lille Valby	8524	361	43	11	0	0	0	0	0	0	136	17.04.2004
EE0009R	Lahemaa	8687	366	111	16	9	2	1	1	0	0	182	07.05.2004
EE0011R	Vilsandy	8583	361	113	20	2	1	0	0	0	0	154	08.05.2004
ES0007R	Víznar	8619	366	376	75	24	9	0	0	0	0	171	02.07.2004
ES0008R	Niembro	8561	365	57	14	2	1	0	0	0	0	158	20.05.2004
ES0009R	Campisabalos	8316	362	175	35	9	6	0	0	0	0	167	21.07.2004
ES0010R	Cabo de Creus	8273	362	533	73	37	11	3	2	0	0	184	30.07.2004
ES0011R	Barcarrola	8292	358	248	36	3	2	0	0	0	0	157	18.06.2004
ES0012R	Zarra	8295	356	323	67	7	5	0	0	0	0	159	28.07.2004
ES0013R	Penausende	8569	366	215	39	5	3	0	0	0	0	177	27.07.2004
ES0014R	Els Torms	8562	365	318	60	21	7	0	0	0	0	178	18.05.2004
ES0015R	Risco Llamo	8446	364	1656	130	163	33	0	0	0	0	180	27.07.2004, 31.07.2004
ES0016R	O Saviñao	8492	366	117	23	15	4	0	0	0	0	177	17.06.2004
FI0009R	Utö	7902	341	59	6	12	2	0	0	0	0	167	07.05.2004
FI0017R	Virolahti II	8622	362	89	14	6	3	0	0	0	0	168	08.05.2004
FI0022R	Oulanka	8101	346	235	17	17	2	0	0	0	0	163	18.04.2004
FI0037R	Ahtari II	8696	366	139	17	0	0	0	0	0	0	150	08.05.2004
FR0008R	Donon A	8481	366	377	44	58	11	7	2	0	0	188	30.07.2004
FR0008R	Donon B	8486	366	431	47	73	11	9	2	0	0	191	30.07.2004
FR0008R	Donon C	8605	366	489	54	82	13	13	2	0	0	192	30.07.2004, 31.07.2004
FR0008R	Donon D	8599	366	453	48	78	12	12	2	0	0	191	30.07.2004
FR0009R	Revin	8481	358	273	40	29	10	3	1	0	0	183	30.07.2004
FR0010R	Morvan	8399	354	134	22	4	1	0	0	0	0	153	31.07.2004

Table 1.1, cont.

Code	Station	Total		>120		>150		>180		>200		Max concentrations	
		hours	days	hours	days	hours	days	hours	days	hours	days	μg/m^3	day(s)
FR0012R	Iraty	7510	322	902	96	113	25	3	3	0	0	182	28.07.2004
FR0013R	Peyrusse Vieille	8455	357	163	34	7	2	0	0	0	0	163	01.08.2004
FR0014R	Montandon	8193	350	63	14	5	1	0	0	0	0	160	31.07.2004
FR0015R	La Tardière	8739	365	140	26	4	1	0	0	0	0	155	01.08.2004
FR0016R	Le Casset	8635	366	928	88	32	5	0	0	0	0	167	31.07.2004
FR0017R	Montfranc	8629	365	76	17	0	0	0	0	0	0	141	30.06.2004
GB0002R	Eskdalemuir	7951	340	10	1	0	0	0	0	0	0	144	08.08.2004
GB0006R	Lough Navar	6573	276	3	1	0	0	0	0	0	0	130	02.08.2004
GB0013R	Yarner Wood	8563	362	42	11	0	0	0	0	0	0	142	05.09.2004
GB0014R	High Muffles	8713	366	74	11	18	4	2	1	0	0	182	08.08.2004
GB0015R	Strath Vaich Dam	7373	316	35	8	0	0	0	0	0	0	138	10.08.2004
GB0031R	Aston Hill	7850	338	29	9	0	0	0	0	0	0	148	02.08.2004, 08.08.2004
GB0032R	Bottesford	8673	365	40	8	10	2	0	0	0	0	166	29.07.2004
GB0033R	Bush	8644	366	13	1	4	1	0	0	0	0	158	08.08.2004
GB0034R	Glazebury	8428	358	23	5	3	2	0	0	0	0	154	29.07.2004, 08.08.2004
GB0035R	Great Dun Fell	8693	365	21	4	0	0	0	0	0	0	138	07.08.2004, 08.08.2004
GB0036R	Harwell	7922	340	79	17	21	5	0	0	0	0	168	29.07.2004, 01.08.2004
GB0037R	Ladybower Res.	7471	318	56	12	7	3	0	0	0	0	160	08.08.2004
GB0038R	Lullington Heath	8396	361	94	19	15	5	1	1	0	0	184	05.09.2004
GB0039R	Sibton	8462	358	80	13	16	5	4	1	2	1	212	08.08.2004
GB0044R	Somerton	8398	359	35	7	0	0	0	0	0	0	150	01.08.2004
GB0045R	Wicken Fen	8187	348	123	24	39	9	1	1	0	0	182	29.07.2004
GR0001R	Aliartos	8761	366	1	1	0	0	0	0	0	0	130	02.04.2004
GR0002R	Finokalia	6687	295	687	70	13	4	0	0	0	0	167	02.08.2004
HU0002R	K-puszta	7806	334	66	13	23	4	6	2	4	1	253	12.09.2004
IE0001R	Valentia Observatory	6397	268	32	8	0	0	0	0	0	0	135	26.05.2004
IE0031R	Mace Head	8637	363	5	2	0	0	0	0	0	0	128	27.05.2004
IT0001R	Montelibretti	8603	360	337	75	64	26	13	8	3	3	210	24.07.2004
IT0004R	Ispra	7143	307	320	79	79	25	9	6	0	0	193	16.07.2004
LT0015R	Preila	8330	354	59	12	1	1	0	0	0	0	154	18.09.2004
LV0010R	Rucava	8069	338	9	2	0	0	0	0	0	0	131	09.04.2004
MT0001R	Giordan Igthouse	7820	328	1365	141	56	19	1	1	0	0	185	10.06.2004

Table 1.1, cont.

Code	Station	Total		>120		>150		>180		>200		Max concentrations	
		hours	days	hours	days	hours	days	hours	days	hours	days	$\mu g/m^3$	day(s)
NO0001R	Birkenes	8640	366	29	7	0	0	0	0	0	0	138	03.05.2004
NO0015R	Tustervatn	8702	366	95	10	0	0	0	0	0	0	141	18.04.2004
NO0039R	Kårvatn	8746	366	53	9	0	0	0	0	0	0	139	08.05.2004
NO0042G	Spitsbergen, Zeppelinfjell	8731	366	0	0	0	0	0	0	0	0	110	26.04.2004
NO0043R	Prestebakke	8748	366	71	13	0	0	0	0	0	0	149	05.09.2004
NO0052R	Sandve	8660	364	29	8	0	0	0	0	0	0	130	04.09.2004
NO0055R	Karasjok	8739	366	110	9	0	0	0	0	0	0	140	06.04.2004
NO0056R	Hurdal	8760	366	67	12	0	0	0	0	0	0	150	09.05.2004
PL0002R	Jarczew	8743	366	88	24	3	2	0	0	0	0	165	09.07.2004
PL0003R	Sniezka	8777	366	126	25	0	0	0	0	0	0	150	12.08.2004
PL0004R	Leba	8776	366	29	5	0	0	0	0	0	0	142	01.05.2004
PL0005R	Diabla Gora	8585	363	13	3	0	0	0	0	0	0	134	11.09.2004
PT0004R	Monte Velho	5443	259	216	70	31	26	0	0	0	0	177	04.06.2004
SE0005R	Bredkälen	5100	214	0	0	0	0	0	0	0	0	118	11.08.2004
SE0011R	Vavihill	8718	366	65	12	0	0	0	0	0	0	135	01.05.2004
SE0012R	Aspvreten	8385	358	99	14	0	0	0	0	0	0	144	09.05.2004
SE0013R	Esrange	8771	366	140	13	0	0	0	0	0	0	140	06.04.2004, 07.04.2004, 19.04.2004
SE0014R	Råö	8766	366	87	17	0	0	0	0	0	0	142	17.04.2004
SE0032R	Norra-Kvill	8705	366	90	13	0	0	0	0	0	0	146	17.04.2004
SE0035R	Vindeln	8745	366	145	16	0	0	0	0	0	0	142	03.05.2004
SE0039R	Grimsö	8616	361	29	7	0	0	0	0	0	0	140	17.04.2004
SI0008R	Iskrba	8289	366	296	52	20	4	1	1	0	0	181	10.06.2004
SI0031R	Zarodnje	8350	366	124	25	0	0	0	0	0	0	148	22.07.2004
SI0032R	Krvavec	8695	366	873	102	80	16	7	1	5	1	218	10.06.2004
SI0033R	Kovk	7623	356	251	45	15	4	5	1	2	1	210	11.06.2004
SK0002R	Chopok	7901	366	709	197	14	14	1	1	0	0	189	24.08.2004
SK0004R	Stará Lesná	8656	363	104	70	0	0	0	0	0	0	140	09.02.2004
SK0006R	Starina	7292	324	149	57	0	0	0	0	0	0	142	27.08.2004
SK0007R	Topolniky	8624	366	246	65	10	10	0	0	0	0	160	07.08.2004

Table 1.2: Percentiles of hourly ozone values April–September 2004.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
AT0002R	Illmitz	59.0	76.0	95.0	114.5	126.0	139.0	146.0	94.4
AT0005R	Vorhegg	64.0	81.0	99.0	114.0	123.0	136.3	145.0	94.1
AT0030R	Pillersdorf bei Retz	65.2	80.0	98.9	115.8	127.1	138.1	145.1	93.6
AT0032R	Sulzberg	79.7	94.3	111.1	127.3	137.7	153.2	162.6	94.6
AT0033R	Stolzalpe bei Murau	56.2	76.5	94.1	106.8	113.1	121.4	127.5	94.1
AT0034G	Sonnblick	97.1	107.0	117.5	129.2	135.9	144.3	147.8	94.7
AT0037R	Zillertaler Alpen	85.8	98.0	110.0	122.1	130.1	142.5	148.4	95.4
AT0038R	Gerlitzen	88.1	99.9	110.8	120.5	126.7	136.0	141.4	95.3
AT0040R	Masenberg	80.9	92.6	106.2	119.8	126.9	135.8	140.0	94.8
AT0041R	Haunsberg	68.8	82.8	99.8	119.7	131.7	145.7	150.7	91.5
AT0042R	Heidenreichstein	53.9	70.8	90.8	108.8	118.7	128.9	136.7	87.4
AT0043R	Forsthof	71.8	86.8	102.8	117.7	127.3	135.7	139.7	89.9
AT0044R	Graz Platte	74.1	90.6	105.2	120.7	128.6	137.0	142.7	92.1
AT0045R	Dunkelsteinerwald	52.9	71.8	90.8	111.7	121.7	132.7	141.7	68.3
AT0046R	Gänserndorf	49.9	69.3	91.8	110.8	121.7	131.7	141.7	94.9
AT0047R	Stixneusiedl	57.9	74.8	94.8	112.7	123.7	137.2	145.7	84.8
BE0001R	Offagne	53.0	69.0	88.0	110.0	124.0	138.0	147.0	90.5
BE0032R	Eupen	48.0	65.0	85.0	106.0	126.0	145.0	160.0	85.0
BE0035R	Vezin	27.0	49.0	72.0	91.0	105.0	120.0	134.9	86.7
BG0053R	Rojen peak	90.4	102.9	114.8	125.0	131.2	137.8	141.7	98.6
CH0002R	Payerne	48.8	70.7	91.1	113.7	126.8	136.4	148.7	92.8
CH0003R	Tänikon	48.5	69.8	90.8	115.2	127.9	145.4	158.6	95.0
CH0004R	Chaumont	81.0	95.2	113.2	130.2	138.7	157.8	171.1	94.8
CH0005R	Rigi	80.2	94.8	111.9	128.7	140.2	157.3	167.2	93.4
CY0002R	Ayia Marina	100.0	111.0	120.0	127.0	132.0	136.9	140.0	88.9
CZ0001R	Svratouch	64.4	78.1	93.1	107.2	114.9	125.2	133.5	98.6
CZ0003R	Kosetice	59.5	74.4	92.2	108.5	117.3	127.9	134.9	98.0
DE0001R	Westerland	76.0	87.0	98.0	110.0	122.0	135.0	143.0	95.2
DE0002R	Langenbrügge	46.0	65.0	84.0	104.9	120.0	133.0	139.0	83.8
DE0003R	Schauinsland	81.0	97.0	117.0	137.0	154.0	177.0	188.0	94.1
DE0004R	Deuselbach	62.0	76.0	94.0	112.0	123.0	137.0	150.6	64.2
DE0005R	Brotjacklriegel	80.0	94.0	109.0	126.0	134.0	143.2	150.1	63.5
DE0007R	Neuglobsow	44.0	64.0	83.0	102.0	113.0	124.0	132.0	91.2
DE0009R	Zingst	55.0	68.0	82.0	94.0	102.0	112.0	118.0	95.3
DE0012R	Bassum	39.0	54.0	71.0	91.0	105.0	121.0	127.9	89.0
DE0026R	Ueckermünde	54.0	71.0	87.0	103.0	112.0	123.2	130.1	95.4
DE0035R	Lückendorf	60.0	76.0	94.0	109.6	120.0	132.0	138.0	91.8
DE0039R	Aukrug	38.0	56.0	71.0	84.0	99.0	120.0	129.0	86.6
DE0042R	Öhringen	46.0	67.0	91.0	116.0	132.0	147.2	157.6	94.2
DE0045R	Schorfheide	43.0	65.0	85.0	104.0	116.0	128.9	135.0	87.8
DE0046R	Raisting	32.0	58.0	84.0	105.7	117.0	135.0	144.0	91.3
DE0047R	Falkenberg	48.0	67.0	87.0	107.0	118.0	128.0	135.0	93.3
DK0005R	Keldsnor	56.1	66.1	75.0	83.8	90.6	98.9	104.5	91.4
DK0031R	Ulborg	49.8	61.1	76.5	91.3	102.9	116.1	124.1	96.6
DK0041R	Lille Valby	52.9	67.3	82.0	95.0	104.5	113.3	120.3	94.2
EE0009R	Lahemaa	46.0	62.0	78.0	96.0	110.0	124.0	131.0	98.2
EE0011R	Vilsandy	67.0	78.0	91.0	106.0	115.0	122.0	129.0	97.0
ES0007R	Víznar	78.4	93.5	106.0	118.0	127.6	138.0	145.0	97.2
ES0008R	Niembro	59.5	72.9	89.2	102.0	109.0	116.0	123.0	97.7
ES0009R	Campisabalos	66.3	82.7	96.3	110.0	118.0	131.0	138.0	94.7
ES0010R	Cabo de Creus	84.1	96.1	110.0	123.0	131.0	141.0	150.0	96.2
ES0011R	Barcarrola	53.3	74.8	96.5	114.0	123.0	131.7	138.0	94.8
ES0012R	Zarra	79.2	91.2	105.0	118.0	126.0	133.0	140.0	92.4
ES0013R	Penausende	69.7	86.1	99.4	113.0	121.0	130.0	137.0	96.9
ES0014R	Els Torms	74.8	89.1	104.8	117.0	125.0	136.0	144.0	97.5
ES0015R	Risco Llamo	99.5	113.0	127.0	140.0	148.0	155.4	161.0	96.3
ES0016R	O Saviñao	47.0	63.6	81.6	97.4	110.5	126.0	136.0	96.3
FI0009R	Utö	63.0	73.0	85.0	97.0	106.0	116.0	128.0	92.4
FI0017R	Virolahti II	47.0	65.0	81.0	96.0	108.0	122.0	129.0	98.8
FI0022R	Oulanka	50.0	63.0	83.0	108.0	124.0	137.0	141.8	87.0
FI0037R	Ahtari II	43.0	58.0	76.0	99.0	113.0	125.0	130.0	98.6
FR0008R	Donon A	68.0	84.0	101.0	117.0	132.0	145.0	157.6	96.6
FR0008R	Donon B	70.0	86.0	103.0	120.0	134.0	148.0	161.0	96.7
FR0008R	Donon C	72.0	87.0	105.0	122.0	136.0	150.0	162.9	98.1
FR0008R	Donon D	71.0	86.0	104.0	121.0	135.0	148.0	161.9	98.1
FR0009R	Revin	54.0	70.0	90.0	111.0	125.0	139.0	147.8	93.8
FR0010R	Morvan	54.0	72.0	88.0	103.0	115.0	125.0	132.0	98.9
FR0012R	Iraty	88.0	103.0	117.0	133.0	143.0	153.0	161.0	92.3
FR0013R	Peyrusse Vieille	61.0	76.0	92.0	107.0	117.0	126.0	133.0	98.0

Table 1.2, cont.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
FR0014R	Montandon	47.0	62.0	77.0	94.0	104.0	117.0	128.1	97.7
FR0015R	La Tardière	52.0	70.0	87.0	104.0	115.0	125.0	130.0	99.3
FR0016R	Le Casset	92.0	104.5	117.0	128.0	135.0	141.0	147.0	98.0
FR0017R	Montfranc	65.0	80.5	94.0	108.0	114.0	120.0	123.0	96.9
GB0002R	Eskdalemuir	42.0	54.0	66.0	80.0	86.0	94.0	100.0	93.7
GB0006R	Lough Navar	40.0	54.0	68.0	80.0	86.0	94.0	98.0	99.2
GB0013R	Yarner Wood	52.0	66.0	80.0	94.0	102.0	114.0	122.0	95.4
GB0014R	High Muffles	52.0	66.0	80.0	94.0	104.0	118.0	132.0	98.4
GB0015R	Strath Vaich Dam	64.0	74.0	86.0	96.0	104.0	114.4	121.2	80.6
GB0031R	Aston Hill	56.0	68.0	78.0	90.0	96.0	108.0	118.0	80.3
GB0032R	Bottesford	32.0	52.0	68.0	82.0	92.0	104.0	118.0	99.0
GB0033R	Bush	46.0	56.0	68.0	78.0	84.0	94.0	102.0	97.5
GB0034R	Glazebury	30.0	52.0	70.0	82.0	90.0	102.0	112.0	93.5
GB0035R	Great Dun Fell	52.0	58.0	72.0	82.0	92.0	104.0	112.0	98.1
GB0036R	Harwell	48.0	62.0	78.0	92.0	102.0	120.0	133.7	98.3
GB0037R	Ladybower Res.	54.0	66.0	80.0	92.0	100.7	118.0	132.0	74.0
GB0038R	Lullington Heath	50.0	66.0	82.0	96.0	104.0	122.8	138.4	95.2
GB0039R	Sibton	42.0	62.0	78.0	90.0	100.0	120.0	136.0	96.0
GB0044R	Somerton	46.0	60.0	74.0	88.0	96.0	111.9	120.0	95.7
GB0045R	Wicken Fen	38.0	60.0	80.0	98.0	112.0	134.0	152.0	87.8
GR0001R	Aliartos	13.0	34.0	54.0	68.0	74.0	79.0	83.0	99.5
GR0002R	Finokalia	92.6	102.1	116.4	128.5	134.9	141.1	145.2	79.4
HU0002R	K-puszta	43.0	62.0	81.0	95.0	104.0	115.0	125.2	95.2
IE0001R	Valentia Observatory	59.6	69.0	82.2	94.8	100.6	107.8	114.6	95.6
IE0031R	Mace Head	64.0	72.0	82.0	96.0	101.4	106.0	110.0	97.6
IT0001R	Montelibretti	21.9	51.2	89.4	115.1	128.7	143.9	157.2	97.2
IT0004R	Ispra	31.8	58.7	86.0	112.8	129.6	149.6	162.5	92.8
LT0015R	Preila	53.0	66.0	81.0	93.5	102.0	109.7	121.9	98.2
LV0010R	Rucava	37.0	55.0	68.0	81.0	88.4	99.1	107.0	84.1
MT0001R	Giordan lgthouse	100.0	111.0	122.0	133.0	140.0	147.0	153.0	90.7
NO0001R	Birkenes	43.6	63.2	74.7	86.6	95.7	109.4	117.4	98.0
NO0015R	Tustervatn	54.2	66.1	82.4	99.1	111.0	120.9	125.9	98.8
NO0039R	Kårvatn	31.7	55.8	72.9	92.5	106.6	115.4	121.0	99.3
NO0042G	Spitsbergen, Zeppelinfjell	58.6	64.5	72.4	88.1	94.9	100.1	103.7	99.0
NO0043R	Prestebakke	52.0	65.6	80.0	93.0	104.2	117.8	127.4	98.7
NO0052R	Sandve	61.8	71.4	81.6	94.2	102.4	112.0	117.9	98.8
NO0055R	Karasjok	54.4	66.0	79.6	93.6	106.0	122.6	129.8	98.8
NO0056R	Hurdal	47.6	63.2	78.8	92.4	104.4	116.8	124.7	99.2
PL0002R	Jarczew	43.0	59.0	76.0	97.0	108.0	120.8	128.0	99.2
PL0003R	Sniezka	66.0	81.0	95.0	107.0	114.0	123.0	128.0	99.5
PL0004R	Leba	55.0	71.0	84.0	96.0	102.0	110.0	116.0	99.4
PL0005R	Diabla Gora	36.0	58.0	73.0	86.0	94.0	101.0	110.0	96.3
PT0004R	Monte Velho	59.0	78.0	96.0	114.0	124.0	139.0	149.0	81.1
SE0005R	Bredkälen	47.0	59.0	71.0	81.0	88.0	98.0	105.0	66.0
SE0011R	Vavihill	54.0	67.0	81.0	94.0	106.0	118.0	124.0	98.3
SE0012R	Aspvreten	49.0	66.0	81.0	97.0	109.0	122.0	129.0	96.0
SE0013R	Esrange	53.0	64.0	80.0	98.0	112.0	130.0	135.0	99.3
SE0014R	Råö	61.0	73.0	85.0	98.0	108.0	120.7	126.0	99.3
SE0032R	Norra-Kvill	60.0	72.0	87.0	103.0	111.0	121.0	128.0	98.7
SE0035R	Vindeln	41.0	61.0	79.0	98.0	112.0	126.0	131.0	98.9
SE0039R	Grimsö	44.0	59.0	73.0	90.0	102.0	112.0	117.0	98.6
SI0008R	Iskrba	19.0	67.0	96.0	115.0	125.0	137.0	143.0	94.6
SI0031R	Zarodnje	64.0	79.0	92.0	106.0	113.0	124.0	131.0	94.5
SI0032R	Krvavec	95.0	106.0	117.0	129.0	138.0	148.0	159.0	98.0
SI0033R	Kovk	68.0	84.0	100.0	115.0	123.0	133.0	140.0	84.3
SK0002R	Chopok	77.0	91.0	106.0	117.0	123.0	129.0	133.0	89.3
SK0004R	Stará Lesná	55.0	75.0	92.0	105.0	112.0	120.1	124.0	98.9
SK0006R	Starina	54.0	79.0	97.0	111.0	118.0	127.0	131.0	82.7
SK0007R	Topolniky	44.0	66.0	90.0	111.0	122.0	132.0	138.9	98.1

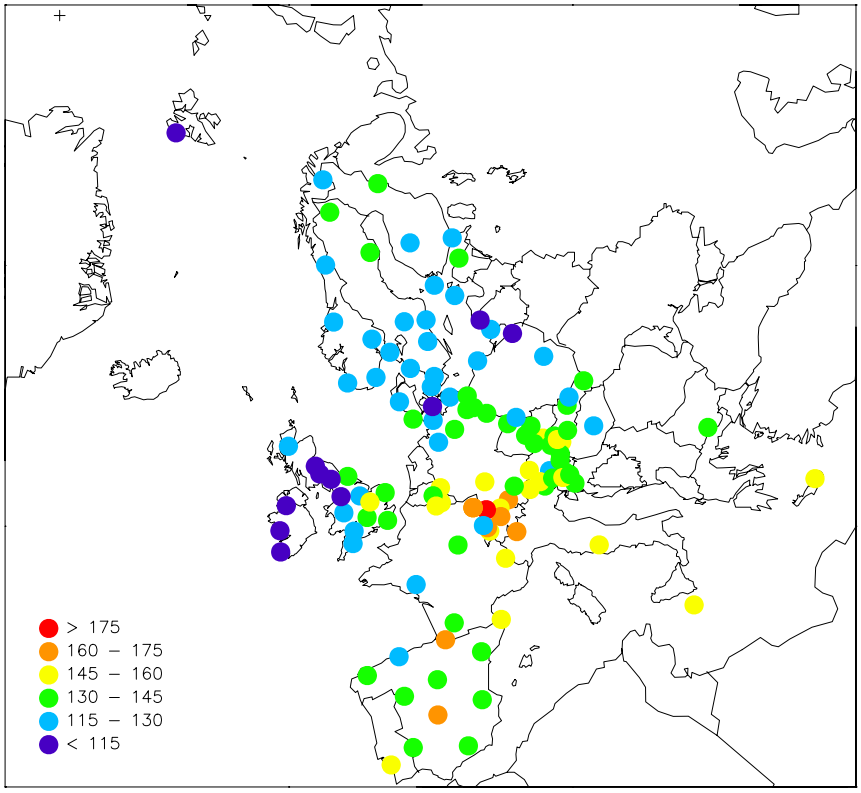


Figure 1.1: Ozone April–September 2004. 99-percentiles (μg/m^3).

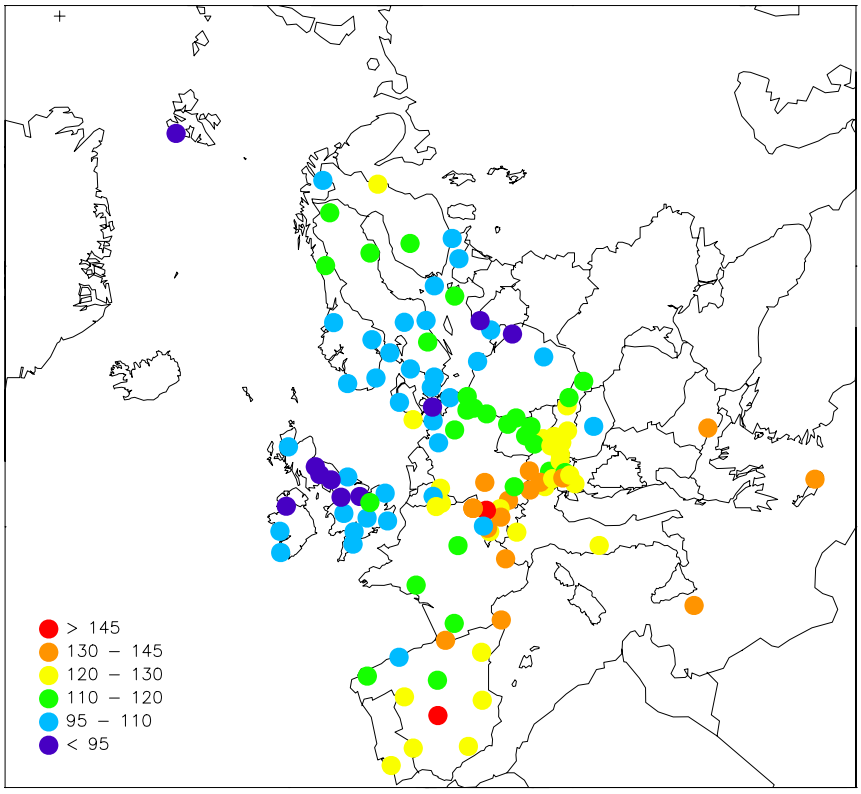


Figure 1.2: Ozone April–September 2004. 95-percentiles (μg/m^3).

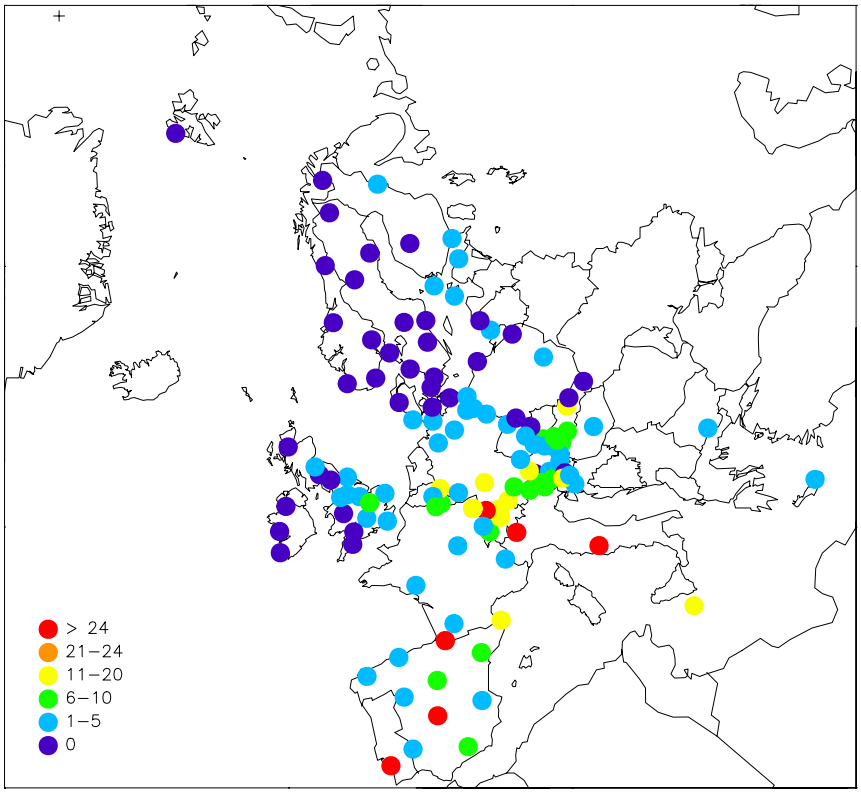


Figure 1.3: Number of exceedances of the threshold value of 150 µg/m^3. (Unit: number of days).

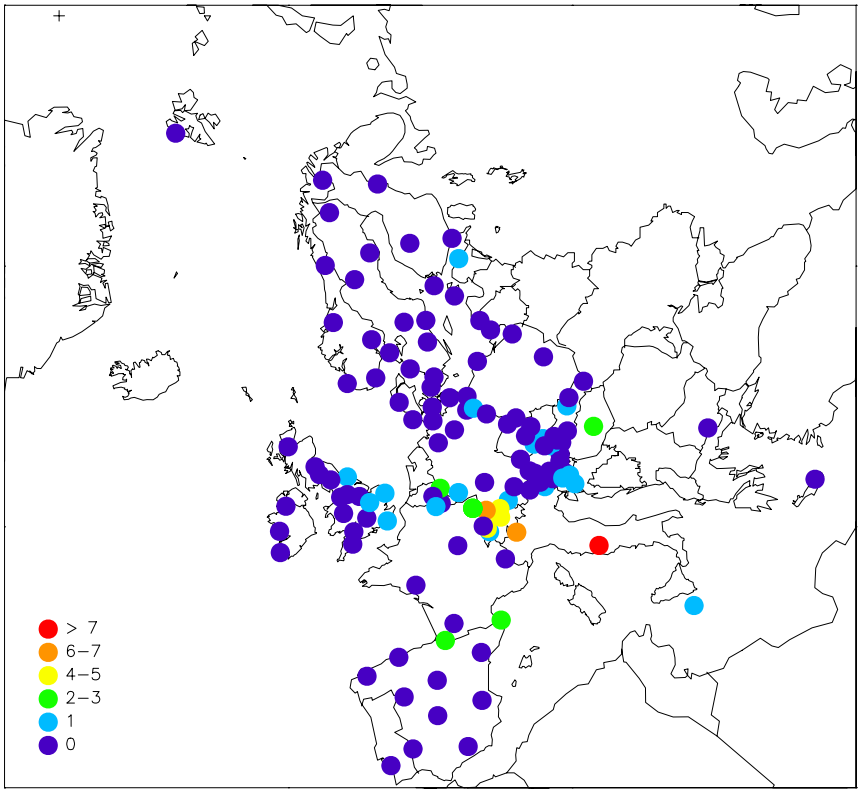


Figure 1.4: Number of exceedances of the threshold value of 180 µg/m^3. (Unit: number of days).

Annex 2

AOT40 and AOT60, figures and tables

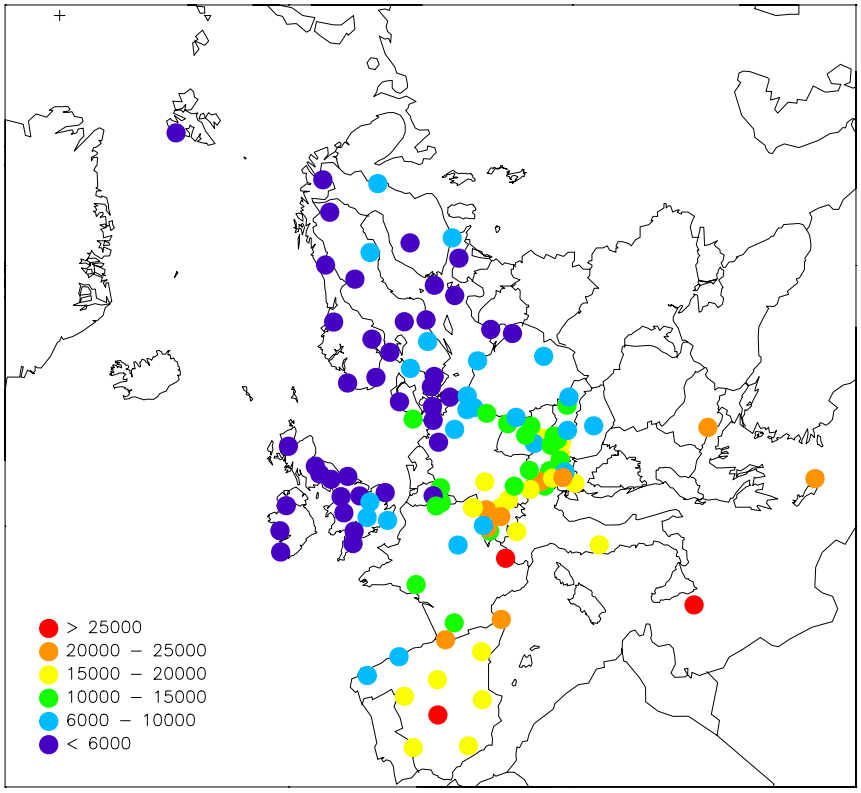


Figure 2.1: AOT40 (ppbh) April–September 2004 (daylight hours).

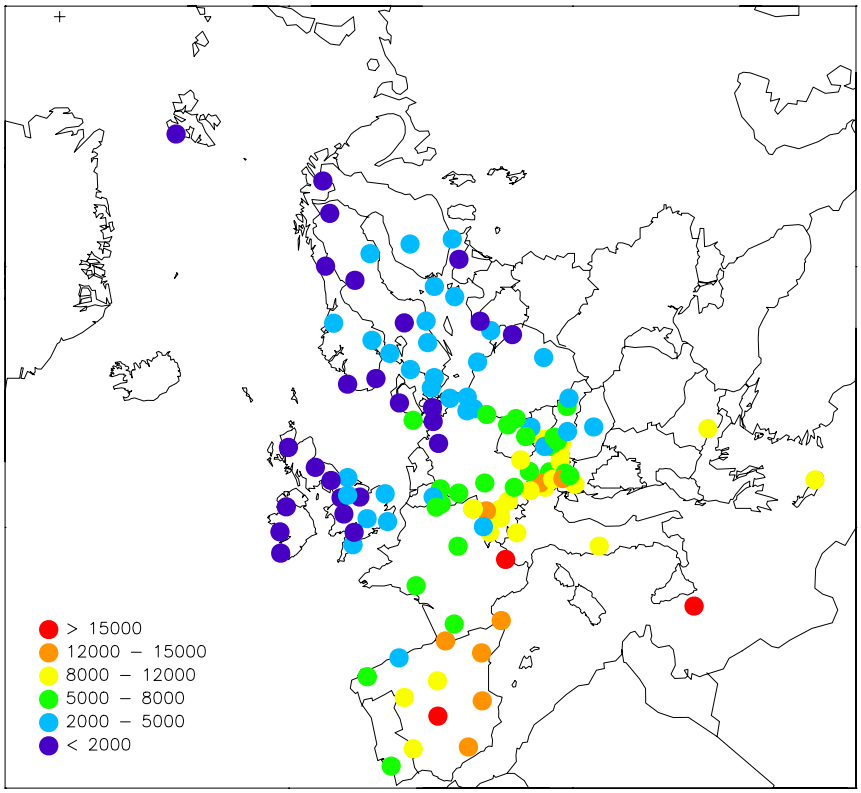


Figure 2.2: AOT40 (ppbh) May, June and July 2004 (daylight hours).

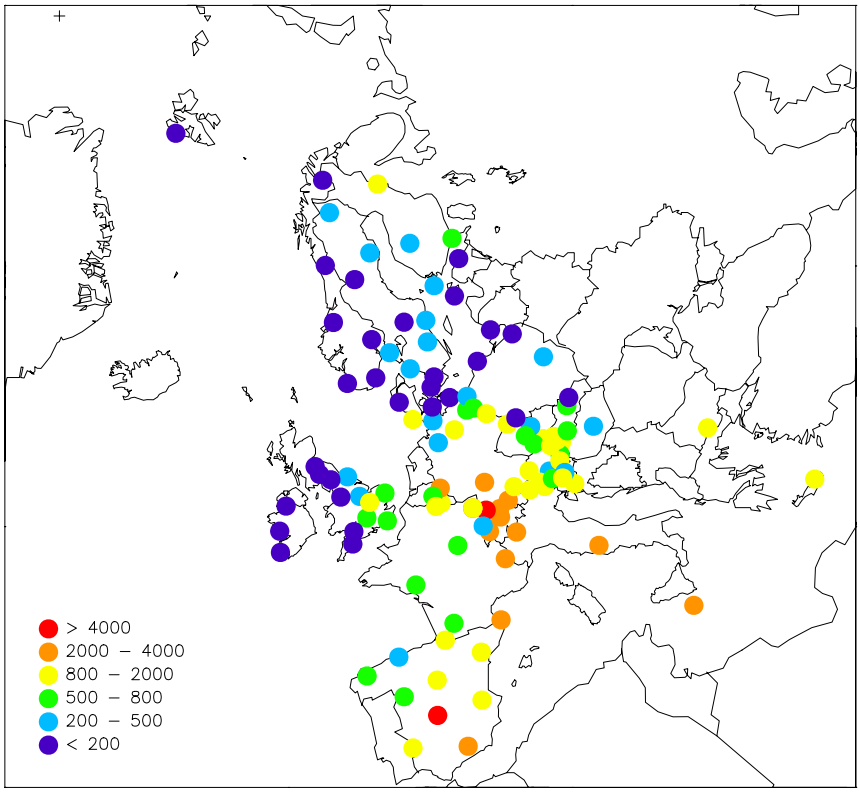


Figure 2.3: AOT60 (ppbh) April-September 2004 (daylight hours).

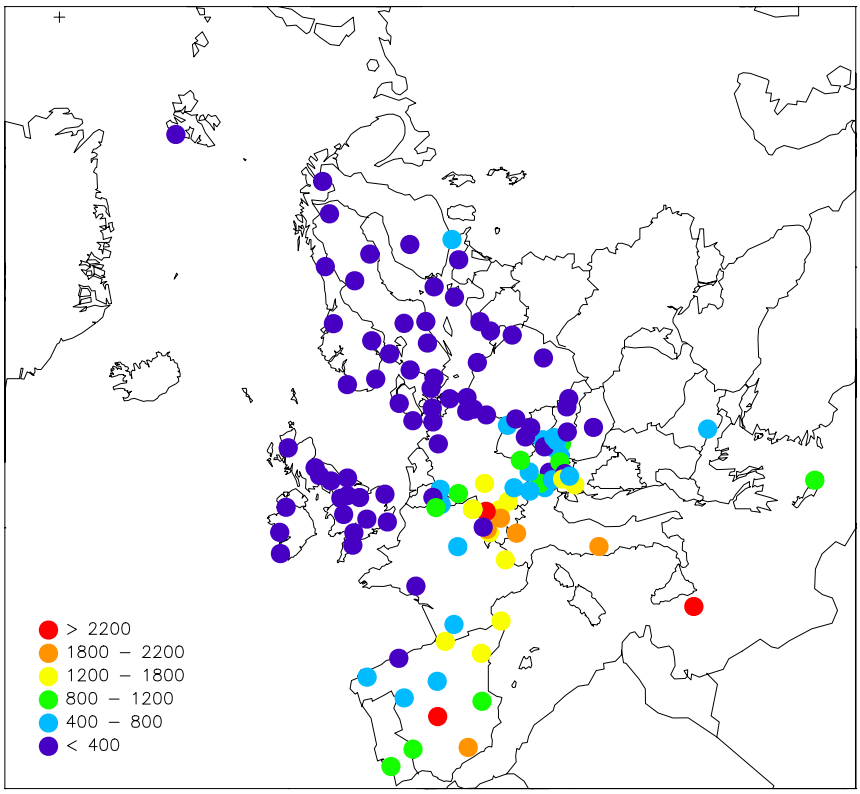


Figure 2.4: AOT60 (ppbh) May, June and July 2004 (daylight hours).

Table 2.1: AOT40 and AOT60 April–September 2004 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT0002R	Illmitz	15137	16030	1822	1929	94
AT0005R	Vorhegg	12634	13763	846	922	92
AT0030R	Pillersdorf bei Retz	15110	16569	1763	1933	91
AT0032R	Sulzberg	19259	19627	2455	2502	98
AT0033R	Stolzalpe bei Murau	11168	12116	278	301	92
AT0034G	Sonnblick	24716	27076	1666	1826	91
AT0037R	Zillertaler Alpen	17312	18168	810	850	95
AT0038R	Gerlitzen	18907	19760	617	645	96
AT0040R	Masenberg	15281	16436	731	786	93
AT0041R	Haunsberg	11572	12787	1414	1563	90
AT0042R	Heidenreichstein	8738	10115	575	666	86
AT0043R	Forsthof	12075	13320	900	993	91
AT0044R	Graz Platte	14283	15744	1198	1321	91
AT0046R	Gänserndorf	11041	11584	941	987	95
AT0047R	Stixneusiedl	10415	12111	1278	1487	86
BE0001R	Offagne	11736	13195	1587	1784	89
BE0032R	Eupen	10232	11853	2030	2351	86
BE0035R	Vezin	5870	6658	712	808	88
BG0053R	Rojen peak	21000	21158	857	863	99
CH0002R	Payerne	14543	15666	2155	2322	93
CH0003R	Tänikon	16302	17088	3212	3366	95
CH0004R	Chaumont	20559	21628	3212	3379	95
CH0005R	Rigi	20277	21796	3608	3878	93
CY0002R	Ayia Marina	29106	32414	2032	2262	90
CZ0001R	Svratouch	10146	10215	378	381	99
CZ0003R	Košetice	12873	13089	733	746	98
DE0001R	Westerland	13336	13952	1095	1145	96
DE0003R	Schauinsland	23693	24517	4963	5135	97
DE0007R	Neuglobsow	8758	9608	546	598	91
DE0009R	Zingst	4884	5114	33	35	96
DE0012R	Bassum	4995	5612	372	418	89
DE0026R	Ueckermünde	8584	8966	343	358	96
DE0035R	Lückendorf	11398	12349	893	968	92
DE0039R	Aukrug	4051	4618	373	425	88
DE0042R	Öhringen	15204	16087	2902	3070	95
DE0045R	Schorfheide	9934	11271	768	871	88
DE0046R	Raisting	11495	12524	1284	1399	92
DE0047R	Falkenberg	11084	11821	821	876	94
DK0005R	Keldsnor	1377	1495	0	0	92
DK0031R	Ulborg	3772	3906	152	157	97
DK0041R	Lille Valby	4691	4986	63	67	94
EE0009R	Lahemaa	3211	3267	168	171	98
EE0011R	Vilsandy	4455	4570	55	57	97
ES0007R	Víznar	19766	20463	2017	2088	97
ES0008R	Niembro	7448	7641	231	236	97
ES0009R	Campisabalos	15484	16357	878	927	95
ES0010R	Cabo de Creus	21533	22541	2042	2137	96
ES0011R	Barcarrola	15565	16499	1111	1178	94
ES0012R	Zarra	18183	19619	1156	1247	93
ES0013R	Penausende	15113	15706	660	685	96
ES0014R	Els Torms	19339	19903	1408	1449	97
ES0015R	Risco Llamo	32934	34195	5200	5399	96
ES0016R	O Saviñao	7655	7995	777	811	96
FI0009R	Utö	5332	5646	262	277	94
FI0017R	Virolahti II	6767	6823	523	527	99
FI0022R	Oulanka	6355	7385	872	1013	86
FI0037R	Ahtari II	5828	5889	390	394	99
FR0008R	Donon A	13138	13302	1526	1545	99
FR0008R	Donon B	15319	15479	1941	1961	99
FR0008R	Donon C	16121	16290	2112	2134	99
FR0008R	Donon D	15449	15611	1969	1990	99
FR0009R	Revin	11888	12712	1704	1822	94
FR0010R	Morvan	9697	9774	595	599	99
FR0012R	Iraty	20273	21966	1891	2048	92
FR0013R	Peyrusse Vieille	11133	11300	658	668	99

Table 2.1, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
FR0014R	Montandon	6151	6203	459	462	99
FR0015R	La Tardière	10740	10772	597	598	100
FR0016R	Le Casset	28289	28359	2518	2524	100
FR0017R	Montfranc	9285	9520	112	114	98
GB0002R	Eskdalemuir	1426	1546	61	66	92
GB0006R	Lough Navar	1295	1298	7	7	100
GB0013R	Yarner Wood	5350	5623	185	194	95
GB0014R	High Muffles	5250	5356	443	452	98
GB0032R	Bottesford	3121	3153	331	334	99
GB0033R	Bush	1109	1138	121	124	97
GB0034R	Glazebury	2664	2864	189	203	93
GB0035R	Great Dun Fell	1524	1550	43	44	98
GB0036R	Harwell	6431	6558	786	802	98
GB0038R	Lullington Heath	6133	6459	681	717	95
GB0039R	Sibton	5707	5973	765	801	96
GB0044R	Somerton	3839	4017	194	203	96
GB0045R	Wicken Fen	7818	8899	1268	1443	88
GR0001R	Aliartos	226	226	0	0	100
GR0002R	Finokalia	20160	24668	1471	1800	82
HU0002R	K-puszta	6984	7209	447	461	97
IE0001R	Valentia Observatory	3752	3776	35	35	99
IE0031R	Mace Head	3779	3858	11	11	98
IT0001R	Montelibretti	16438	16859	2914	2988	98
IT0004R	Ispra	15418	16715	3164	3430	92
LT0015R	Preila	4700	4742	158	159	99
MT0001R	Giordan lgthouse	29207	32194	3212	3540	91
NO0001R	Birkenes	3732	3839	80	82	97
NO0015R	Tustervatn	4999	5060	130	131	99
NO0039R	Kårvatn	4732	4748	134	134	100
NO0042G	Spitsbergen, Zeppelinfjell	1300	1309	0	0	99
NO0043R	Prestebakke	5584	5647	289	292	99
NO0052R	Sandve	4938	4975	35	35	99
NO0055R	Karasjok	3994	4009	165	166	100
NO0056R	Hurdal	5224	5254	200	201	99
PL0002R	Jarczew	7599	7621	427	428	100
PL0003R	Sniezka	8309	8309	110	110	100
PL0004R	Leba	6406	6409	115	115	100
PL0005R	Diabla Gora	2801	2900	16	16	97
SE0005R	Bredkälen	1087	1098	0	0	99
SE0011R	Vavihill	5285	5342	132	133	99
SE0012R	Aspvreten	5664	5909	308	321	96
SE0013R	Esrange	4847	4858	295	295	100
SE0014R	Råö	6588	6604	217	217	100
SE0032R	Norra-Kvill	7424	7503	289	292	99
SE0035R	Vindeln	6226	6292	459	464	99
SE0039R	Grimsö	3976	4021	68	68	99
SI0008R	Iskrba	15829	16671	1627	1714	95
SI0031R	Zarodnje	8465	8544	282	284	99
SI0032R	Krvavec	24752	25386	1847	1894	98
SK0002R	Chopok	13354	14880	504	562	90
SK0004R	Stará Lesná	7231	7277	110	111	99
SK0007R	Topolniky	8058	8174	629	638	99

Table 2.2: AOT40 and AOT60 May–July 2004 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT0002R	Illmitz	8121	8455	909	946	96
AT0005R	Vorhegg	8300	8941	774	834	93
AT0030R	Pillersdorf bei Retz	8069	8843	688	754	91
AT0032R	Sulzberg	10666	10855	1416	1442	98
AT0033R	Stolzalpe bei Murau	6628	7230	199	218	92
AT0034G	Sonnblick	14091	15556	1078	1190	91
AT0037R	Zillertaler Alpen	8885	9354	412	434	95
AT0038R	Gerlitzen	10544	11206	515	548	94
AT0040R	Masenberg	8622	9401	436	476	92
AT0041R	Haunsberg	5918	6798	643	738	87
AT0043R	Forsthof	6265	7291	411	478	86
AT0044R	Graz Platte	8259	9327	822	928	89
AT0045R	Dunkelsteinerwald	4776	5062	272	289	94
AT0046R	Gänserndorf	6339	6630	579	606	96
AT0047R	Stixneusiedl	6219	6523	792	831	95
BE0001R	Offagne	6179	6941	739	830	89
BE0032R	Eupen	5371	5716	770	820	94
BE0035R	Vezin	3000	3283	236	258	91
BG0053R	Rojen peak	10653	10793	442	448	99
CH0002R	Payerne	8208	9045	1287	1418	91
CH0003R	Tänikon	9136	9594	1769	1857	95
CH0004R	Chaumont	11587	12225	1944	2052	95
CH0005R	Rigi	11576	12553	2199	2385	92
CY0002R	Ayia Marina	15406	17241	1070	1197	89
CZ0001R	Svratouch	4717	4738	152	153	100
CZ0003R	Kosetice	6233	6284	211	213	99
DE0001R	Westerland	6703	7018	262	274	96
DE0002R	Langenbrügge	2639	2788	110	116	95
DE0003R	Schauinsland	12812	13324	2830	2943	96
DE0004R	Deuselbach	6545	6587	831	836	99
DE0005R	Brotjacklriegel	9513	9998	1077	1132	95
DE0007R	Neuglobsow	3552	3831	21	22	93
DE0009R	Zingst	2086	2173	0	0	96
DE0012R	Bassum	1858	2053	50	55	90
DE0026R	Ueckermünde	3872	4023	63	65	96
DE0035R	Lückendorf	5360	5828	403	438	92
DE0039R	Aukrug	1422	1485	48	50	96
DE0042R	Öhringen	7879	8387	1300	1383	94
DE0045R	Schorfheide	4741	5357	195	220	88
DE0046R	Raisting	6693	7299	618	673	92
DE0047R	Falkenberg	5370	5798	255	275	93
DK0005R	Keldsnor	649	653	0	0	99
DK0031R	Ulborg	1972	2021	78	80	98
DK0041R	Lille Valby	2224	2435	23	26	91
EE0009R	Lahemaa	1648	1676	164	166	98
EE0011R	Vilsandy	2333	2339	43	43	100
ES0007R	Víznar	12965	13421	1833	1897	97
ES0008R	Niembro	4667	4809	202	208	97
ES0009R	Campisabalos	9325	9889	677	717	94
ES0010R	Cabo de Creus	12929	13591	1655	1740	95
ES0011R	Barcarrola	10551	11135	1084	1144	95
ES0012R	Zarra	12298	12832	970	1012	96
ES0013R	Penausende	9209	9654	587	615	95
ES0014R	Els Torms	12240	12659	1252	1294	97
ES0015R	Risco Llamo	19433	20127	3696	3828	97
ES0016R	O Saviñao	5490	5726	644	672	96
FI0009R	Utö	3081	3224	261	273	96
FI0017R	Virolahti II	3627	3674	437	442	99
FI0037R	Ahtari II	2257	2281	211	213	99
FR0008R	Donon A	7563	7683	989	1004	98
FR0008R	Donon B	8858	8973	1254	1270	99
FR0008R	Donon C	9161	9289	1300	1318	99
FR0008R	Donon D	8844	8967	1259	1277	99
FR0009R	Revin	5898	6616	886	993	89
FR0010R	Morvan	5830	5879	432	436	99
FR0012R	Iraty	12001	13428	1496	1674	89

Table 2.2, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
FR0013R	Peyrusse Vieille	7711	7725	516	517	100
FR0014R	Montandon	3732	3769	304	307	99
FR0015R	La Tardière	6469	6493	302	303	100
FR0016R	Le Casset	16637	16682	1621	1625	100
FR0017R	Montfranc	7124	7271	79	81	98
GB0002R	Eskdalemuir	518	564	0	0	92
GB0006R	Lough Navar	482	484	0	0	100
GB0013R	Yarner Wood	2606	2774	37	39	94
GB0014R	High Muffles	2468	2499	157	159	99
GB0015R	Strath Vaich Dam	1838	1976	2	2	93
GB0031R	Aston Hill	1208	1234	48	49	98
GB0032R	Bottesford	1260	1275	139	141	99
GB0033R	Bush	287	294	0	0	98
GB0034R	Glazebury	1526	1715	84	94	89
GB0035R	Great Dun Fell	457	467	0	0	98
GB0036R	Harwell	2879	2955	268	275	97
GB0037R	Ladybower Res.	2194	2229	152	154	98
GB0038R	Lullington Heath	2467	2605	294	310	95
GB0039R	Sibton	2285	2455	293	315	93
GB0044R	Somerton	1615	1715	8	8	94
GR0001R	Aliartos	137	137	0	0	100
GR0002R	Finokalia	11476	11984	980	1023	96
HU0002R	K-puszta	3774	3944	85	88	96
IE0001R	Valentia Observatory	1666	1680	34	35	99
IE0031R	Mace Head	1524	1531	11	11	100
IT0001R	Montelibretti	10369	10880	2127	2232	95
IT0004R	Ispra	9282	10786	2168	2519	86
LT0015R	Preila	2661	2661	31	31	100
LV0010R	Rucava	395	455	0	0	87
MT0001R	Giordan lgthouse	16814	18805	2440	2728	89
NO0001R	Birkenes	1954	2031	78	81	96
NO0015R	Tustervatn	1972	2005	8	8	98
NO0039R	Kårvatn	2041	2048	68	69	100
NO0042G	Spitsbergen, Zeppelinfjell	233	235	0	0	99
NO0043R	Prestebakke	2886	2934	191	194	98
NO0052R	Sandve	1916	1921	3	3	100
NO0055R	Karasjok	1775	1783	25	25	100
NO0056R	Hurdal	2981	3010	177	179	99
PL0002R	Jarczew	3796	3816	164	165	99
PL0003R	Sniezka	5070	5070	85	84	100
PL0004R	Leba	3613	3612	26	26	100
PL0005R	Diabla Gora	992	1011	0	0	98
PT0004R	Monte Velho	7474	8636	874	1010	87
SE0005R	Bredkälen	635	637	0	0	100
SE0011R	Vavihill	2354	2381	34	34	99
SE0012R	Aspvreten	2723	2869	183	192	95
SE0013R	Esrange	1786	1793	8	8	100
SE0014R	Råö	3284	3298	88	88	100
SE0032R	Norra-Kvill	3659	3713	134	136	99
SE0035R	Vindeln	2258	2284	137	138	99
SE0039R	Grimsö	1684	1699	16	16	99
SI0008R	Iskrba	9892	10567	1312	1401	94
SI0031R	Zarodnje	5380	5409	279	281	99
SI0032R	Krvavec	14873	15037	1667	1685	99
SI0033R	Kovk	7562	8718	630	726	87
SK0002R	Chopok	6904	7765	246	277	89
SK0004R	Stará Lesná	4348	4384	61	62	99
SK0007R	Topolniky	4027	4064	307	310	99

Annex 3

Seasonal variation

Table 3.1: Monthly mean concentrations 2004 (μg/m³).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT0002R	Illmitz	47.3	61.1	69.7	77.7	82.5	80.4	80.2	81.8	62.5	35.9	36.4	26.8
AT0004R	St. Koloman	68.5	80.0	92.6	-	-	-	-	-	-	-	-	-
AT0005R	Vorhegg	66.6	78.8	93.3	84.8	93.3	84.0	84.6	82.3	59.3	44.6	50.5	60.4
AT0030R	Pillersdorf bei Retz	49.8	62.3	73.5	81.0	85.0	83.7	85.2	90.5	69.9	32.4	40.1	33.0
AT0032R	Sulzberg	68.1	80.0	93.6	102.7	98.2	95.9	100.1	99.1	80.6	59.9	50.0	64.1
AT0033R	Stolzalpe bei Murau	71.5	80.1	93.9	86.7	88.2	76.6	72.6	69.3	53.5	41.5	58.9	62.9
AT0034G	Sonnblick	85.3	95.6	105.5	111.7	114.3	106.8	109.7	109.0	93.1	85.9	80.0	87.8
AT0037R	Zillertaler Alpen	75.8	87.2	98.3	104.7	104.2	93.0	99.8	103.6	84.2	76.6	78.2	83.0
AT0038R	Gerlitzen	76.5	91.0	103.5	106.7	106.3	98.3	100.2	103.3	80.4	72.7	70.9	78.8
AT0040R	Masenberg	65.0	77.1	92.6	96.1	100.5	94.4	94.8	99.7	75.9	55.4	61.1	68.9
AT0041R	Haunsberg	56.7	67.2	80.5	86.8	87.4	86.8	86.0	93.8	71.3	46.0	43.4	37.3
AT0042R	Heidenreichstein	51.3	62.0	72.5	72.9	72.0	69.5	73.4	80.2	63.5	36.8	40.7	34.5
AT0043R	Forsthof	58.9	69.5	89.7	88.7	94.2	88.7	88.0	94.6	72.8	44.8	39.0	32.6
AT0044R	Graz Platte	44.3	63.5	88.8	91.9	95.1	90.5	90.6	96.2	72.9	44.8	43.2	17.6
AT0045R	Dunkelsteinerwald	26.6	61.5	73.1	73.5	76.5	69.1	71.9	79.3	54.5	-	37.5	25.5
AT0046R	Gänserndorf	48.2	61.3	70.7	73.1	77.7	70.2	74.0	73.9	58.1	38.8	34.0	24.6
AT0047R	Stixneusiedl	45.9	58.1	74.7	81.0	79.2	76.7	80.9	83.0	59.6	38.8	37.0	27.1
BG0053R	Rojen peak	80.9	96.8	101.0	107.8	105.1	96.8	104.6	105.4	95.4	78.6	80.3	81.1
CH0002R	Payerne	41.6	46.6	57.9	77.1	77.7	70.2	75.0	69.4	58.9	33.5	24.8	26.2
CH0003R	Tänikon	44.5	47.9	58.0	73.3	76.9	73.5	74.4	74.7	57.2	32.0	28.3	25.3
CH0004R	Chaumont	66.9	77.7	89.1	101.8	102.7	95.7	103.2	96.6	87.2	67.6	56.6	65.5
CH0005R	Rigi	66.9	76.5	86.6	100.2	102.4	95.6	101.9	98.3	83.5	62.2	50.1	57.7
CY0002R	Ayia Marina	80.3	84.4	98.5	110.4	109.0	105.9	114.9	108.2	107.3	96.8	83.3	75.7
CZ0001R	Svratouch	54.7	65.2	75.7	83.4	77.0	80.0	78.6	84.8	69.5	55.4	48.1	56.0
CZ0003R	Košetice	54.4	66.1	80.7	79.4	76.0	74.5	75.3	82.7	67.7	42.6	40.0	36.8
DE0001R	Westerland	45.3	71.7	74.4	90.8	94.5	84.4	85.6	87.1	78.3	52.8	62.4	59.3
DE0002R	Langenbrügge	38.0	50.1	60.1	72.9	68.8	62.3	72.0	67.4	55.0	35.6	37.0	31.1
DE0003R	Schauinsland	59.5	81.2	91.7	104.7	103.9	96.1	106.8	107.5	89.7	72.9	60.9	72.1
DE0004R	Deuselbach	49.3	54.0	67.2	84.2	77.2	75.7	77.4	117.7	-	-	-	-
DE0005R	Brotjacklriegel	60.3	66.8	85.9	98.2	94.6	96.1	92.3	-	-	-	-	-
DE0007R	Neuglobsow	34.7	59.4	67.4	72.6	71.1	62.2	60.1	64.7	52.2	31.1	36.1	30.6
DE0009R	Zingst	45.9	58.1	68.3	79.8	77.3	67.2	64.5	64.5	57.9	44.1	47.7	35.5
DE0012R	Bassum	35.4	48.3	53.0	66.5	60.1	53.5	53.2	58.3	51.2	28.2	27.2	9.4
DE0026R	Ueckermünde	38.7	50.6	62.0	83.1	80.1	67.6	67.7	69.4	57.3	40.6	40.2	29.6
DE0035R	Lückendorf	44.8	57.3	71.0	80.7	76.4	77.5	78.4	83.0	68.6	45.4	42.3	33.3
DE0039R	Aukrug	29.6	50.7	57.5	66.1	51.4	60.8	56.2	54.8	47.3	29.8	33.9	26.2

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DE0042R	Öhringen	42.5	42.8	57.9	76.0	69.3	70.5	70.8	76.5	56.9	30.4	23.9	4.9
DE0045R	Schorfheide	36.2	50.0	58.6	63.1	66.4	66.0	66.2	69.2	52.2	34.6	34.6	30.3
DE0046R	Raisting	44.4	52.3	57.2	66.4	65.4	64.5	61.3	58.4	43.2	27.6	-	-
DE0047R	Falkenberg	38.3	49.6	58.8	73.4	71.1	68.5	67.9	71.7	59.0	34.3	32.7	28.0
DK0005R	Keldsnor	42.0	54.6	61.4	64.2	68.2	68.8	66.9	67.7	60.2	46.9	46.6	41.3
DK0031R	Ulborg	40.3	59.3	70.3	77.6	82.8	60.8	54.5	54.7	53.0	39.4	48.3	-
DK0041R	Lille Valby	42.0	57.7	69.6	76.1	79.6	68.0	61.5	60.9	56.3	42.3	41.9	38.8
EE0009R	Lahemaa	47.6	65.2	71.1	84.6	77.0	62.4	52.6	50.2	50.6	42.1	44.3	42.7
EE0011R	Vilsandy	61.7	68.2	74.7	90.0	86.5	82.7	75.2	77.2	69.2	54.5	60.7	55.6
ES0007R	Víznar	64.7	72.0	82.5	91.6	87.2	101.5	105.6	85.5	83.2	67.6	63.7	58.9
ES0008R	Niembro	62.7	71.2	77.4	89.5	90.4	74.9	61.5	64.6	67.6	63.5	54.2	46.1
ES0009R	Campisabalos	60.7	62.9	75.2	82.2	84.0	80.7	88.6	82.0	69.8	71.6	56.5	58.1
ES0010R	Cabo de Creus	67.1	65.6	90.9	102.8	104.9	98.7	98.7	91.4	88.9	78.6	59.8	51.9
ES0011R	Barcarrola	39.2	48.3	63.3	72.6	77.6	84.1	80.1	61.4	71.7	61.5	50.4	45.9
ES0012R	Zarra	57.1	71.8	79.7	90.3	95.0	102.1	98.4	86.4	79.1	71.9	62.2	56.1
ES0013R	Penausende	59.0	68.4	79.8	86.6	85.1	90.5	89.9	77.8	81.2	72.6	54.7	53.2
ES0014R	Els Torms	53.1	48.2	76.4	86.4	92.2	95.8	94.9	88.6	81.6	72.7	46.4	41.7
ES0015R	Risco Llamo	70.0	86.8	95.7	108.4	110.5	119.1	122.4	109.8	110.2	93.2	83.7	72.2
ES0016R	O Saviñao	49.0	57.1	73.5	78.7	75.6	69.0	64.2	56.2	49.6	61.3	39.5	40.6
FI0009R	Utö	62.1	67.2	73.1	84.4	84.1	77.7	68.5	69.2	61.9	60.1	61.0	62.1
FI0017R	Virolahti II	40.9	61.8	67.4	82.5	76.3	64.1	57.9	51.2	53.5	42.0	47.1	43.8
FI0022R	Oulanka	57.0	74.4	85.5	102.7	82.8	67.2	54.9	50.1	47.1	50.5	59.0	60.7
FI0037R	Ahtari II	49.8	65.1	76.3	94.3	70.4	64.2	53.2	45.8	42.9	39.6	52.6	57.8
FR0008R	Donon A	60.7	66.4	78.7	91.0	83.3	89.5	91.8	86.3	71.7	60.2	47.4	53.4
FR0008R	Donon B	61.5	67.5	80.0	92.7	85.6	92.0	94.5	88.9	73.8	61.9	48.7	54.8
FR0008R	Donon C	62.3	68.3	80.9	94.1	87.2	93.4	96.8	91.1	75.6	63.7	50.0	57.0
FR0008R	Donon D	61.8	67.9	80.4	93.2	86.2	92.4	95.7	89.9	74.6	63.0	48.8	54.9
FR0009R	Revin	45.2	51.5	65.5	82.2	79.3	72.5	70.5	72.0	62.3	43.2	33.3	26.9
FR0010R	Morvan	52.6	56.6	71.3	83.3	80.4	73.8	65.1	62.1	60.7	52.0	41.4	45.5
FR0012R	Iraty	79.9	89.3	99.2	106.4	110.9	106.2	105.3	97.6	95.8	85.4	75.8	-
FR0013R	Peyrusse Vieille	54.2	57.5	75.0	80.9	84.7	81.9	77.0	65.8	71.4	58.4	37.7	34.5
FR0014R	Montandon	45.9	45.0	58.4	66.6	64.0	62.2	67.5	64.4	55.0	43.6	31.4	32.5
FR0015R	La Tardière	50.8	51.8	67.4	78.0	79.7	73.8	62.7	62.2	64.8	50.0	34.0	32.8
FR0016R	Le Casset	85.2	95.2	103.1	114.9	113.9	102.1	110.5	96.6	89.6	71.0	73.8	72.8
FR0017R	Montfranc	64.9	69.2	81.7	89.7	93.4	85.4	75.2	70.8	66.0	58.7	51.8	58.1

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB0002R	Eskdalemuir	51.5	56.3	61.9	64.6	63.3	50.9	43.8	51.8	48.2	43.8	45.9	43.2
GB0006R	Lough Navar	-	-	60.3	65.4	62.0	48.6	43.3	48.7	48.6	44.4	58.3	55.1
GB0013R	Yarner Wood	64.8	62.8	73.7	81.0	77.3	65.1	52.4	55.5	58.8	54.6	54.1	49.7
GB0014R	High Muffles	56.4	71.9	73.9	76.2	79.7	62.1	59.3	69.8	55.9	50.8	49.2	43.8
GB0015R	Strath Vaich Dam	75.9	78.7	86.3	87.6	82.3	69.3	64.9	74.8	57.1	62.9	73.4	72.4
GB0031R	Aston Hill	62.4	63.5	70.6	79.5	70.3	63.4	57.9	73.1	64.5	62.7	65.4	62.6
GB0032R	Bottesford	43.7	48.8	51.6	59.9	54.7	46.2	44.4	54.4	45.1	37.7	31.2	32.1
GB0033R	Bush	55.4	55.7	63.8	66.2	60.2	52.3	50.6	60.9	50.5	42.7	50.1	49.5
GB0034R	Glazebury	34.5	42.8	47.3	54.5	52.6	56.2	47.8	46.2	41.4	33.5	34.7	30.1
GB0035R	Great Dun Fell	61.9	70.8	74.6	73.4	70.1	50.9	54.6	66.9	54.1	56.7	57.9	51.3
GB0036R	Harwell	55.8	54.9	55.9	71.3	64.7	63.5	58.6	64.6	59.1	56.4	36.0	39.4
GB0037R	Ladybower Res.	59.2	66.6	67.4	73.6	75.2	61.1	57.3	83.6	44.8	53.3	59.9	55.4
GB0038R	Lullington Heath	59.5	54.7	69.1	75.3	65.6	63.7	61.3	70.0	66.4	60.9	45.5	42.7
GB0039R	Sibton	44.6	56.8	58.7	66.7	66.1	59.2	52.2	64.5	58.5	48.5	40.1	40.1
GB0044R	Somerton	55.5	50.3	60.1	69.0	67.1	58.9	50.7	60.4	57.8	51.0	41.4	40.1
GB0045R	Wicken Fen	43.8	56.0	60.1	71.2	64.6	59.2	54.2	64.4	55.1	42.8	34.2	31.8
GR0001R	Aliartos	20.0	29.4	43.0	43.9	39.6	31.2	38.1	29.5	29.0	19.3	21.4	14.7
GR0002R	Finokalia	-9900.0	67.4	90.5	97.0	95.3	106.0	104.8	116.1	107.7	78.8	75.0	74.4
HU0002R	K-puszta	54.1	51.5	72.8	68.8	67.9	67.2	57.1	54.4	57.0	37.5	29.4	11.7
IT0001R	Montelibretti	29.9	33.1	40.9	47.4	59.3	62.8	72.7	64.8	38.5	24.9	17.2	8.6
IT0004R	Ispra	-	58.0	56.6	68.9	65.0	70.0	70.7	59.3	40.5	23.2	20.7	15.5
LT0015R	Preila	50.8	68.7	77.0	78.1	75.3	72.3	55.0	60.3	54.7	42.1	28.8	35.8
LV0010R	Rucava	47.0	52.5	62.6	69.7	58.5	57.0	51.7	45.1	47.1	32.9	38.3	33.5
NO0001R	Birkenes	43.7	59.8	69.6	66.8	72.5	58.6	53.6	53.6	48.1	40.5	45.4	49.1
NO0015R	Tustervatn	68.8	80.8	91.5	97.9	83.5	67.8	52.9	58.0	55.2	55.0	70.6	73.0
NO0039R	Kårvatn	67.8	71.8	84.8	80.2	70.4	55.3	42.0	40.5	37.2	37.3	52.9	62.2
NO0042G	Spitsbergen, Zeppelinfj.	75.0	81.1	90.0	85.9	64.8	60.3	62.8	62.2	64.2	74.2	70.4	68.3
NO0043R	Prestebakke	52.3	63.8	72.7	77.9	78.1	69.8	56.3	58.3	54.3	44.5	48.9	52.1
NO0052R	Sandve	56.4	65.3	75.3	80.3	77.6	70.2	65.3	69.5	66.0	58.4	60.3	62.7
NO0055R	Karasjok	62.9	80.0	91.0	94.9	78.9	68.9	63.5	54.0	51.4	62.3	71.0	69.4
NO0056R	Hurdal	43.6	60.6	74.8	74.1	80.4	66.6	54.2	56.3	47.7	36.6	45.6	47.3
PL0002R	Jarczew	48.4	58.4	66.7	58.5	69.6	62.2	64.1	63.4	47.6	39.6	35.7	30.5
PL0003R	Sniezka	51.2	59.4	70.9	70.0	82.4	84.3	83.7	81.4	73.1	58.1	53.0	68.0
PL0004R	Leba	48.8	46.4	75.6	77.7	80.5	75.5	64.5	62.1	57.0	44.5	48.8	42.9
PL0005R	Diabla Gora	52.1	64.7	71.6	66.5	54.3	60.7	57.0	31.5	56.9	45.7	46.7	44.3

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PT0004R	Monte Velho	44.5	39.0	50.4	74.9	86.6	92.9	84.3	64.2	54.6	-	-	-
SE0005R	Bredkälen	-	-	-	-	-	72.2	55.4	60.3	48.2	41.8	58.6	61.6
SE0011R	Vavihill	43.9	52.2	64.5	77.9	78.0	67.8	61.5	65.3	57.6	44.9	47.2	41.8
SE0012R	Aspvreten	57.0	65.7	74.6	82.2	78.2	67.4	54.0	60.8	49.0	43.7	47.2	43.9
SE0013R	Esrange	57.5	78.4	91.4	99.1	80.7	67.6	56.4	51.9	50.8	53.8	70.2	71.8
SE0014R	Råö	51.0	59.2	70.3	79.7	81.2	76.5	66.8	70.6	62.2	50.8	49.9	49.5
SE0032R	Norra-Kvill	52.8	68.3	80.9	89.5	84.0	78.0	65.0	70.3	62.1	52.6	55.2	52.7
SE0035R	Vindeln	54.7	69.2	81.6	92.9	76.2	62.2	47.1	44.9	37.1	35.5	45.2	50.8
SE0039R	Grimsö	45.2	65.6	71.9	74.6	67.4	62.3	52.8	52.9	46.0	37.6	50.6	48.8
SI0008R	Iskrba	48.7	58.0	68.3	65.3	69.3	64.0	62.8	60.5	47.6	42.0	35.2	30.0
SI0031R	Zarodnje	47.0	59.7	79.4	81.6	85.3	76.4	83.5	80.8	62.1	43.2	38.3	33.1
SI0032R	Krvavec	74.4	88.4	101.9	108.4	110.7	106.8	110.6	109.4	92.0	82.9	74.5	84.7
SI0033R	Kovk	55.6	65.3	84.6	84.2	90.0	85.5	89.2	81.0	65.4	48.9	41.6	31.7
SK0002R	Chopok	55.7	85.2	77.8	113.4	110.0	106.9	109.3	110.8	96.3	86.0	70.4	84.5
SK0004R	Stará Lesná	48.1	64.3	70.3	63.9	51.8	48.0	39.4	49.0	38.0	35.1	43.1	40.7
SK0006R	Starina	-	-	64.4	70.3	61.6	56.5	56.8	49.9	46.4	34.0	43.4	43.2
SK0007R	Topolniky	40.4	57.6	58.8	56.4	59.8	55.5	57.3	55.4	45.1	30.7	28.5	23.8

Table 3.2: Monthly data capture 2004 (μg/m³).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT0002R	Illmitz	96	89	92	94	95	94	95	95	95	95	46	95
AT0004R	St. Koloman	99	100	69	0	0	0	0	0	0	0	0	0
AT0005R	Vorhegg	95	95	96	95	95	95	95	92	95	95	95	95
AT0030R	Pillersdorf bei Retz	95	95	95	94	95	96	94	94	91	62	93	92
AT0032R	Sulzberg	99	96	98	93	95	93	97	96	96	95	96	96
AT0033R	Stolzalpe bei Murau	60	95	95	95	92	95	95	95	95	95	95	95
AT0034G	Sonnblick	51	96	94	96	95	95	95	95	95	95	96	96
AT0037R	Zillertaler Alpen	96	93	96	96	96	96	96	96	96	96	95	96
AT0038R	Gerlitzen	96	96	95	96	96	95	95	96	96	95	96	96
AT0040R	Masenberg	96	96	96	95	95	95	95	96	96	95	95	95
AT0041R	Haunsberg	96	96	95	95	93	83	90	95	96	91	95	95
AT0042R	Heidenreichstein	95	95	91	93	95	54	94	95	96	95	95	96
AT0043R	Forsthof	90	96	87	96	67	96	95	95	93	94	93	95
AT0044R	Graz Platte	95	91	91	95	95	94	80	95	96	96	96	52
AT0045R	Dunkelsteinerwald	95	89	92	50	95	95	92	66	12	0	52	95
AT0046R	Gänserndorf	95	95	95	95	96	96	95	96	96	95	87	95
AT0047R	Stixneusiedl	95	96	95	95	95	96	96	59	72	95	96	95
BE0001R	Offagne	92	92	91	79	94	92	92	94	95	92	94	75
BE0032R	Eupen	94	92	84	49	95	90	92	94	93	90	78	84
BE0035R	Vezin	93	92	91	79	90	90	91	82	91	91	79	91
BG0053R	Rojen peak	97	100	98	100	100	95	100	100	100	99	100	97
CH0002R	Payerne	95	95	92	95	85	93	95	96	95	95	96	95
CH0003R	Tänikon	96	96	95	95	96	95	95	96	95	95	95	95
CH0004R	Chaumont	96	95	95	95	96	95	95	96	95	95	96	95
CH0005R	Rigi	96	95	95	94	95	88	95	95	95	95	94	95
CY0002R	Ayia Marina	92	95	94	87	82	93	90	91	94	88	92	94
CZ0001R	Svratouch	100	99	100	98	99	100	99	99	100	99	84	95
CZ0003R	Košetice	89	100	84	98	100	99	98	99	97	99	96	97
DE0001R	Westerland	96	96	96	95	96	96	96	95	96	96	96	96
DE0002R	Langenbrügge	92	96	95	95	95	95	30	96	96	94	95	95
DE0003R	Schauinsland	93	96	96	96	92	96	95	94	95	96	96	91
DE0004R	Deuselbach	96	96	96	96	96	96	96	4	0	0	0	0
DE0005R	Brotjacklriegel	98	98	97	98	97	98	92	0	0	0	0	0
DE0007R	Neuglobsow	90	86	91	91	92	92	92	91	92	91	92	91
DE0009R	Zingst	96	96	96	95	95	96	96	96	96	96	96	96
DE0012R	Bassum	92	92	92	91	92	89	92	83	90	92	92	38

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DE0026R	Ueckermünde	96	96	96	96	96	96	96	96	96	96	96	96
DE0035R	Lückendorf	77	96	96	94	92	92	92	92	92	92	92	92
DE0039R	Aukrug	96	96	96	42	96	96	96	96	96	95	89	96
DE0042R	Öhringen	96	96	96	96	96	96	88	96	96	95	96	4
DE0045R	Schorfheide	83	92	92	89	81	92	84	91	92	91	92	92
DE0046R	Raisting	91	91	92	92	92	92	92	87	96	19	0	0
DE0047R	Falkenberg	96	96	76	96	96	96	83	96	96	95	96	96
DK0005R	Keldsnor	99	100	100	100	100	98	100	55	100	32	61	55
DK0031R	Ulborg	100	95	100	96	100	94	100	97	95	99	76	0
DK0041R	Lille Valby	100	100	100	94	83	98	96	99	99	99	99	100
EE0009R	Lahemaa	100	100	98	99	100	98	97	100	97	100	97	100
EE0011R	Vilsandy	100	99	96	84	100	100	100	99	98	98	99	98
ES0007R	Víznar	96	99	99	96	99	96	98	99	99	99	98	99
ES0008R	Niembro	97	98	91	97	99	95	99	99	99	98	97	99
ES0009R	Campisabalos	99	95	99	97	95	91	96	96	97	84	90	99
ES0010R	Cabo de Creus	96	93	91	97	98	92	99	97	97	94	78	98
ES0011R	Barcarrola	98	98	70	98	99	98	92	88	98	98	98	99
ES0012R	Zarra	87	99	99	97	98	99	95	97	70	94	99	99
ES0013R	Penausende	98	99	98	99	98	93	99	97	99	97	98	96
ES0014R	Els Torms	99	99	90	99	96	99	96	99	98	99	98	98
ES0015R	Risco Llamo	93	92	98	96	97	98	96	97	98	93	97	99
ES0016R	O Saviñao	99	99	94	95	97	98	96	97	97	98	96	93
FI0009R	Utö	100	91	100	100	87	98	100	92	80	100	68	62
FI0017R	Virolahti II	97	100	100	100	98	100	100	99	100	85	100	100
FI0022R	Oulanka	95	100	100	96	99	100	40	95	97	91	97	100
FI0037R	Ahtari II	97	100	100	100	99	100	99	99	98	100	97	99
FR0008R	Donon A	99	96	92	97	96	96	99	97	98	96	95	98
FR0008R	Donon B	98	96	92	97	96	96	99	97	98	97	95	98
FR0008R	Donon C	100	97	93	98	97	98	100	99	100	98	96	100
FR0008R	Donon D	100	97	93	98	97	98	100	99	100	98	94	100
FR0009R	Revin	99	100	100	100	97	100	72	99	99	100	95	99
FR0010R	Morvan	85	91	99	100	100	99	99	99	100	99	98	79
FR0012R	Iraty	99	99	99	93	94	88	86	98	98	99	74	0
FR0013R	Peyrusse Vieille	100	100	99	100	100	100	100	94	97	98	92	76
FR0014R	Montandon	97	75	98	98	98	98	98	98	98	92	98	69

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
FR0015R	La Tardière	100	99	100	100	100	100	100	100	100	100	100	97
FR0016R	Le Casset	98	99	99	99	98	99	99	98	99	99	96	99
FR0017R	Montfranc	98	99	99	99	99	97	99	91	99	99	99	99
GB0002R	Eskdalemuir	100	99	100	100	100	79	99	95	92	34	91	98
GB0006R	Lough Navar	0	0	1	100	99	100	100	100	100	100	100	98
GB0013R	Yarner Wood	99	96	100	100	99	99	84	95	99	100	100	100
GB0014R	High Muffles	100	99	99	97	99	100	99	100	99	100	100	99
GB0015R	Strath Vaich Dam	97	100	92	100	89	93	99	84	21	33	100	100
GB0031R	Aston Hill	100	96	99	76	99	96	98	63	52	94	99	100
GB0032R	Bottesford	99	100	100	99	100	100	99	100	100	96	99	93
GB0033R	Bush	99	95	99	100	97	98	99	99	96	100	100	100
GB0034R	Glazebury	95	100	96	100	70	100	100	100	96	100	97	100
GB0035R	Great Dun Fell	99	100	99	100	100	100	94	100	99	100	100	98
GB0036R	Harwell	95	96	97	99	99	100	95	99	99	19	86	98
GB0037R	Ladybower Res.	99	95	100	99	97	99	99	24	28	81	100	100
GB0038R	Lullington Heath	85	98	95	98	93	95	97	99	92	96	100	99
GB0039R	Sibton	99	100	100	100	100	82	99	98	100	78	100	100
GB0044R	Somerton	99	96	98	100	86	100	99	94	99	99	96	83
GB0045R	Wicken Fen	100	98	94	96	56	85	99	97	97	100	100	97
GR0001R	Aliartos	100	99	100	100	100	100	100	100	100	100	98	100
GR0002R	Finokalia	0	82	73	57	99	100	89	92	41	84	98	98
HU0002R	K-puszta	100	100	100	100	100	90	97	94	93	91	100	3
IE0001R	Valentia Observatory	99	100	100	100	100	97	100	100	79	0	0	0
IE0031R	Mace Head	100	100	100	100	100	100	99	90	100	99	100	93
IT0001R	Montelibretti	100	97	94	100	100	100	87	100	100	99	100	100
IT0004R	Ispra	0	15	100	100	81	83	97	100	99	100	99	100
LT0015R	Preila	100	89	88	100	100	100	100	100	92	88	97	84
LV0010R	Rucava	100	100	100	51	58	99	100	99	100	100	99	97
MT0001R	Giordan lgthouse	100	100	100	100	100	100	69	81	99	100	20	100
NO0001R	Birkenes	99	98	99	100	99	96	99	99	98	95	99	99
NO0015R	Tustervatn	100	100	99	100	98	99	100	99	100	99	96	99
NO0039R	Kårvatn	100	99	98	100	100	100	100	100	100	100	100	100
NO0042G	Spitsbergen, Zeppelinfjell	100	100	99	100	100	99	99	100	100	99	100	98
NO0043R	Prestebakke	100	100	100	100	100	97	100	100	99	100	100	100
NO0052R	Sandve	100	99	89	100	100	100	100	98	99	100	100	100

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NO0055R	Karasjok	100	100	100	100	100	99	100	99	99	100	98	100
NO0056R	Hurdal	100	99	100	100	100	100	99	100	100	99	100	100
PL0002R	Jarczew	100	100	100	100	99	100	100	100	100	100	96	100
PL0003R	Sniezka	100	100	100	100	100	100	100	100	100	99	100	100
PL0004R	Leba	100	100	100	100	100	100	100	100	100	100	99	100
PL0005R	Diabla Gora	97	100	100	100	98	97	100	90	96	100	95	100
PT0004R	Monte Velho	88	84	85	87	86	89	87	86	53	0	0	0
SE0005R	Bredkälen	0	0	0	0	0	100	100	100	96	99	100	100
SE0011R	Vavihill	100	99	100	100	97	100	100	100	97	100	99	100
SE0012R	Aspvreten	93	95	88	100	99	89	99	94	99	100	93	98
SE0013R	Esrange	99	100	100	100	100	100	99	100	100	100	100	100
SE0014R	Råö	99	100	100	100	99	100	100	100	100	100	99	100
SE0032R	Norra-Kvill	99	99	99	100	98	100	99	100	99	100	97	99
SE0035R	Vindeln	99	100	100	99	100	99	99	100	99	100	100	100
SE0039R	Grimsö	84	100	100	97	99	100	99	100	100	99	100	100
SI0008R	Iskrba	96	93	87	95	93	96	95	96	96	96	95	95
SI0031R	Zarodnje	96	95	95	92	95	96	95	96	96	95	95	95
SI0032R	Krvavec	100	99	99	99	100	99	98	97	97	99	100	100
SI0033R	Kovk	95	94	90	92	91	87	83	83	72	80	80	94
SK0002R	Chopok	90	90	91	90	89	88	90	91	90	90	89	91
SK0004R	Stará Lesná	88	100	100	100	99	100	99	99	99	99	100	100
SK0006R	Starina	82	83	83	83	83	83	83	83	83	83	83	83
SK0007R	Topolniky	98	99	98	98	99	100	99	98	98	97	97	97

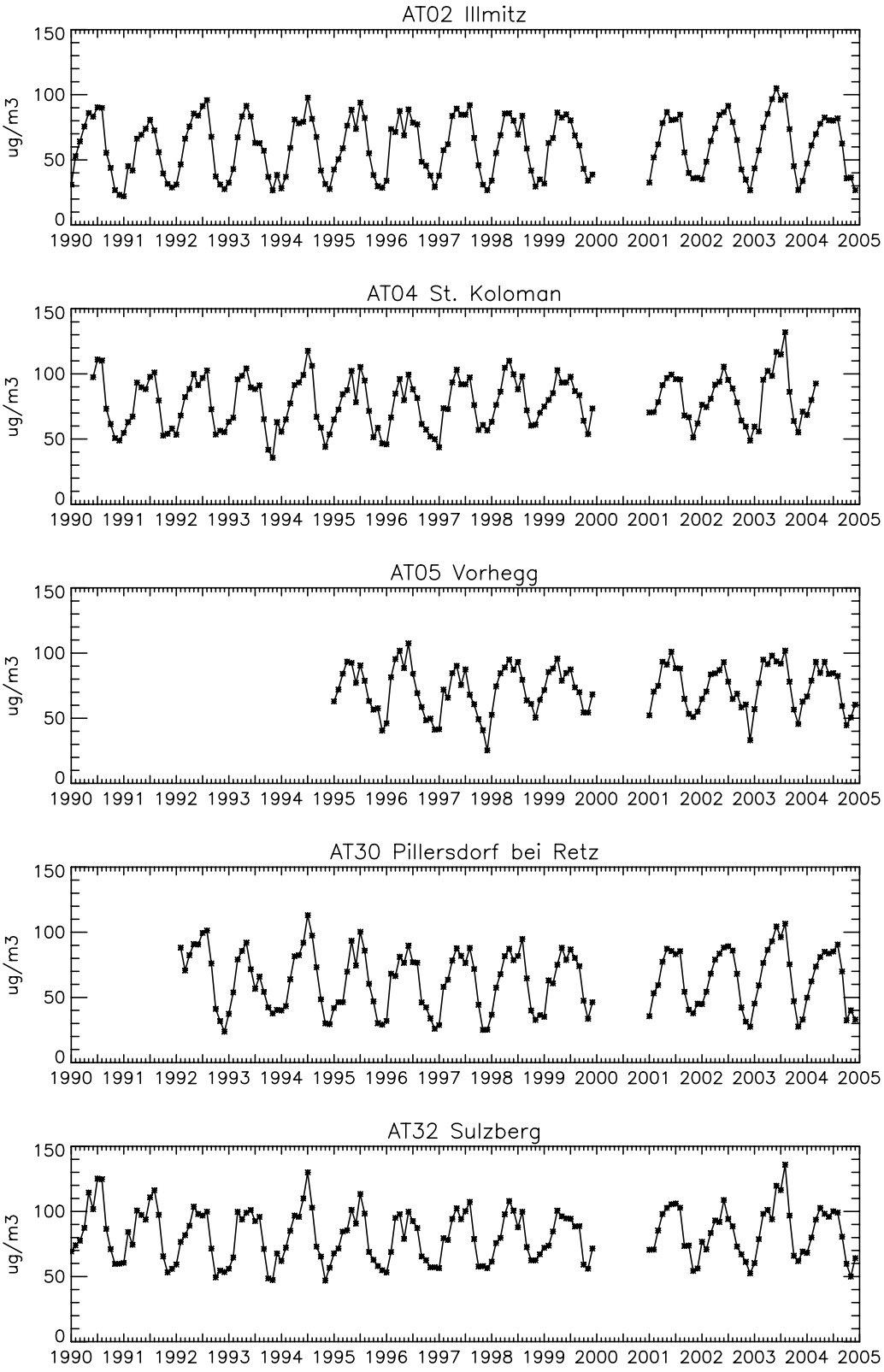
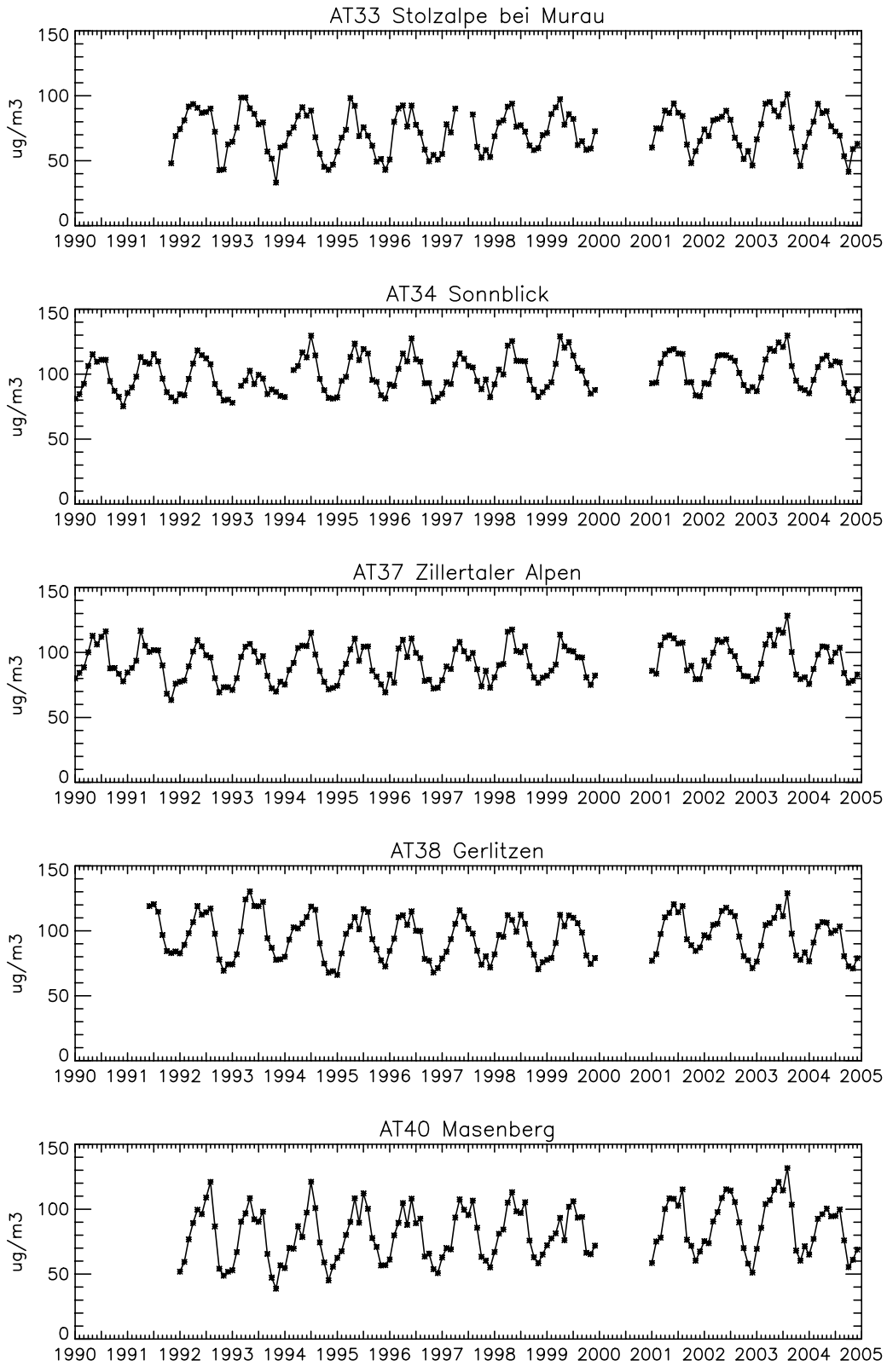


Figure 3.1: Seasonal variation, 1990–2004.



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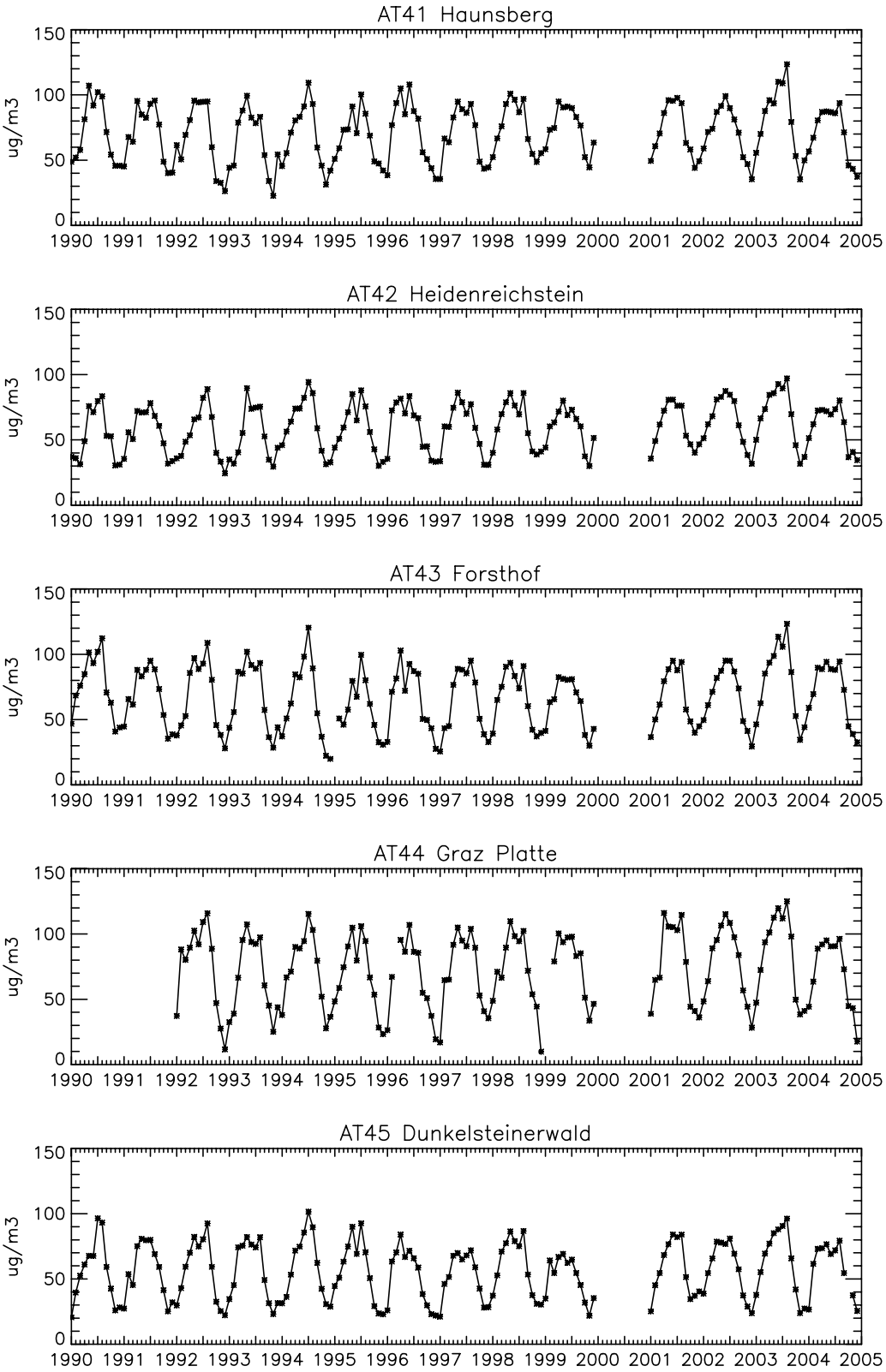

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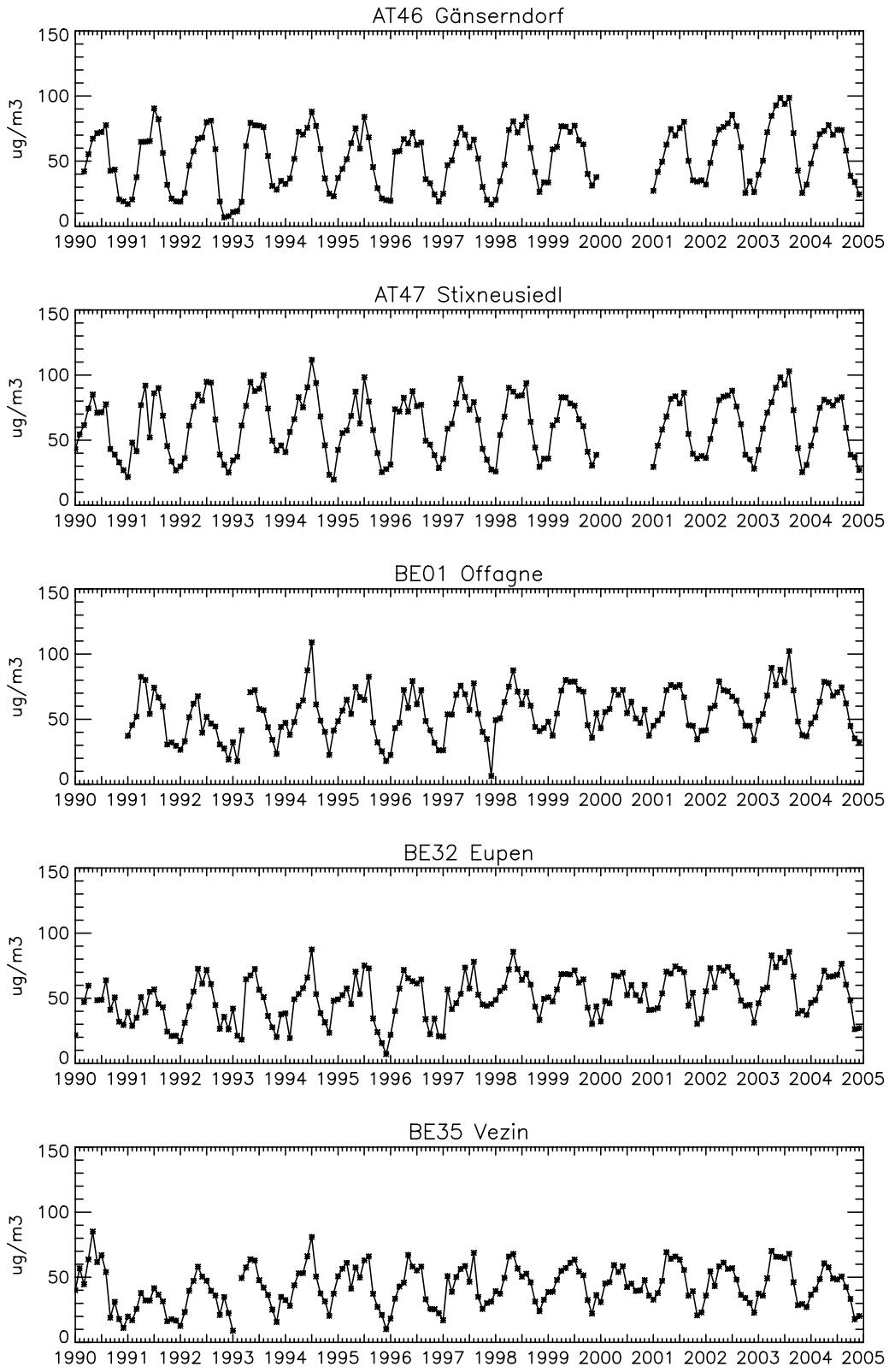

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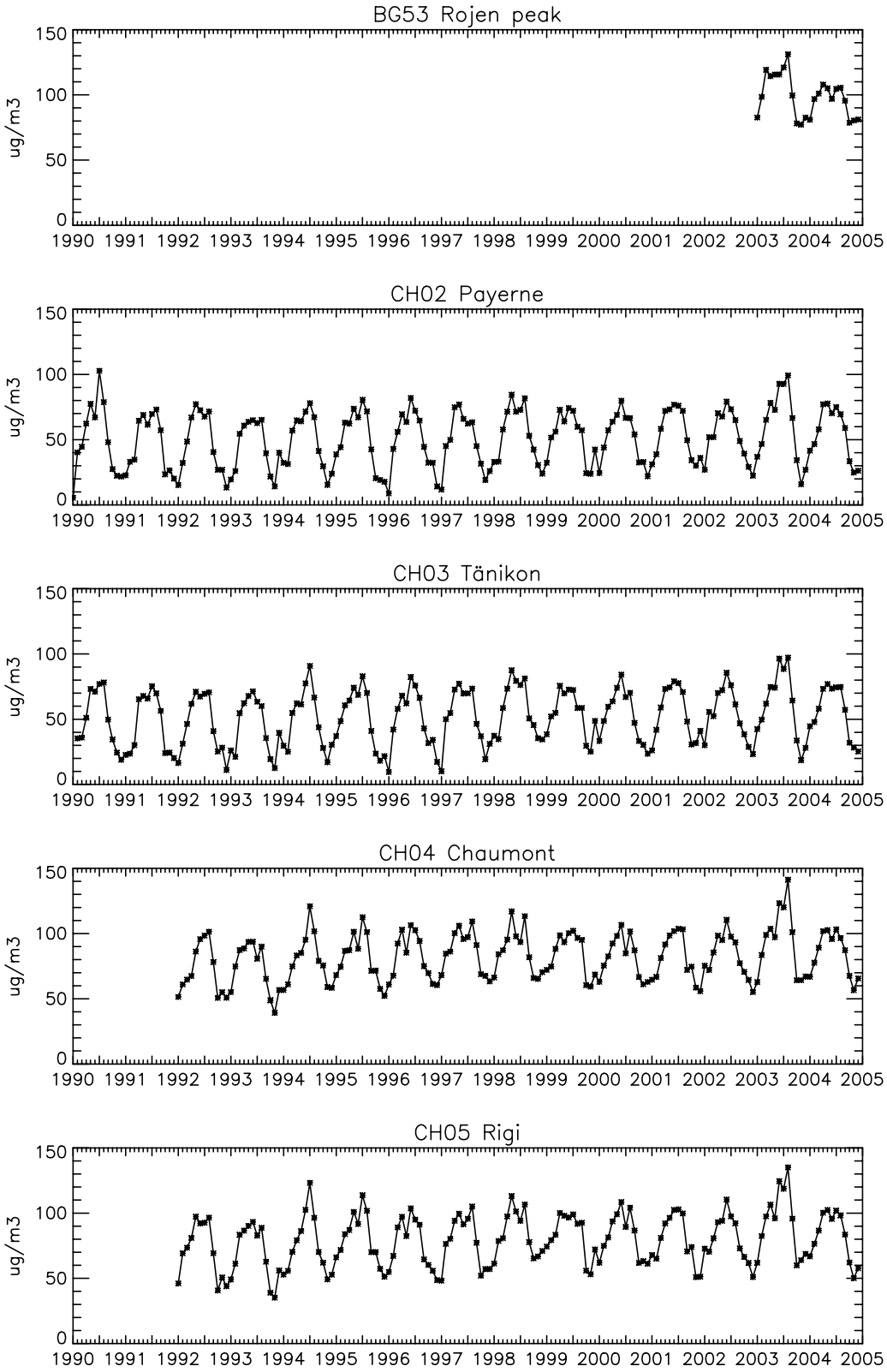

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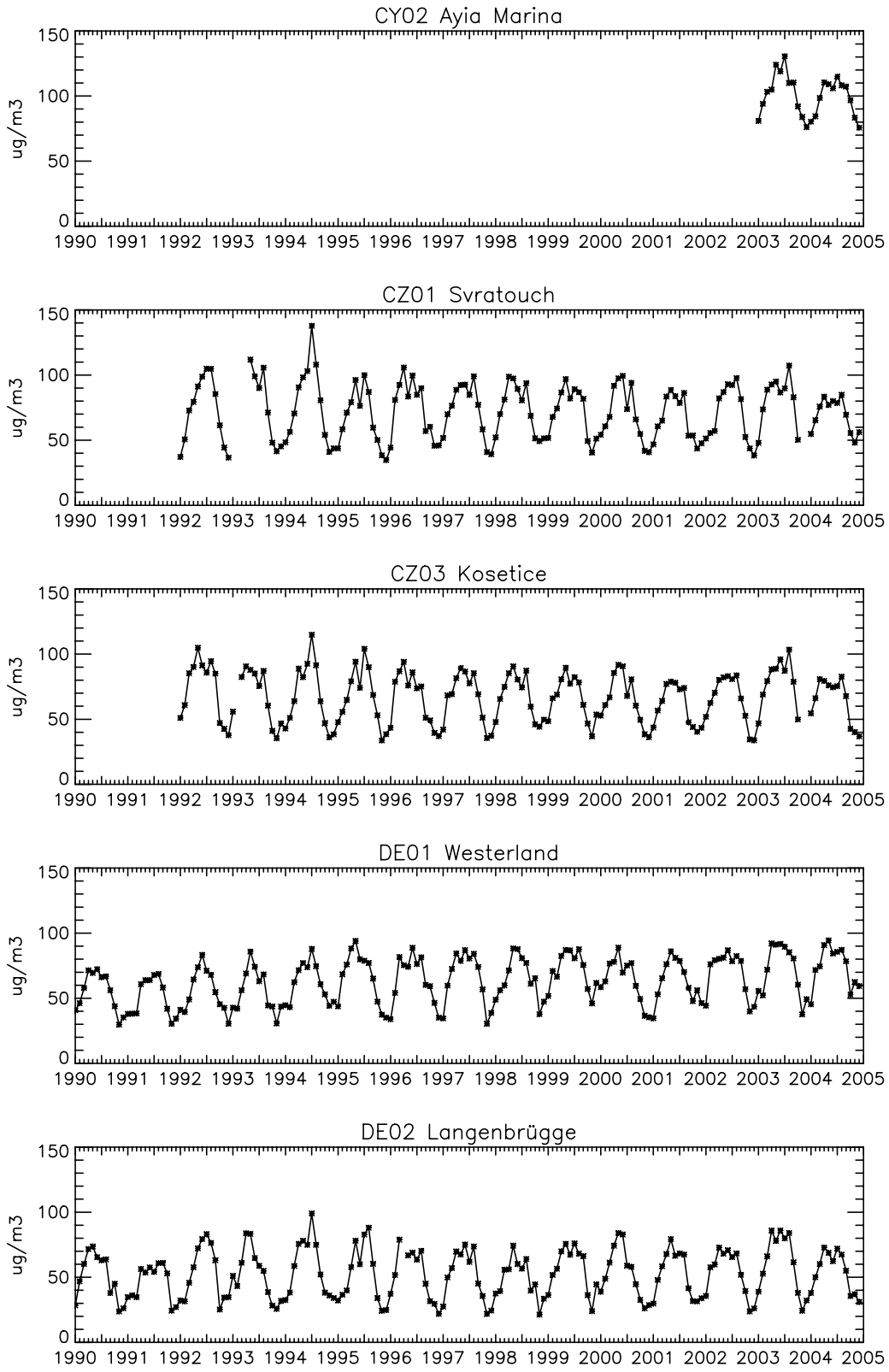

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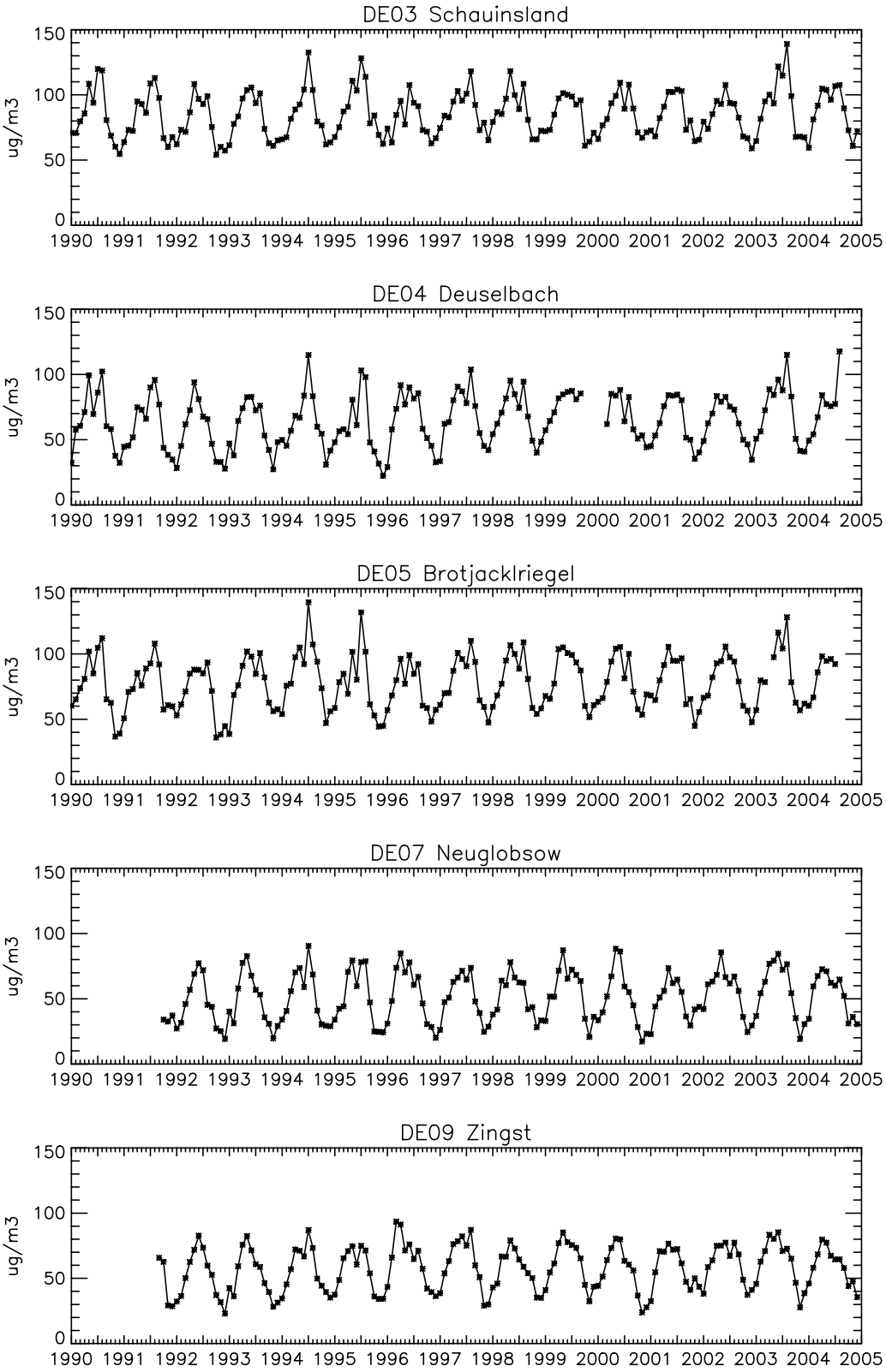

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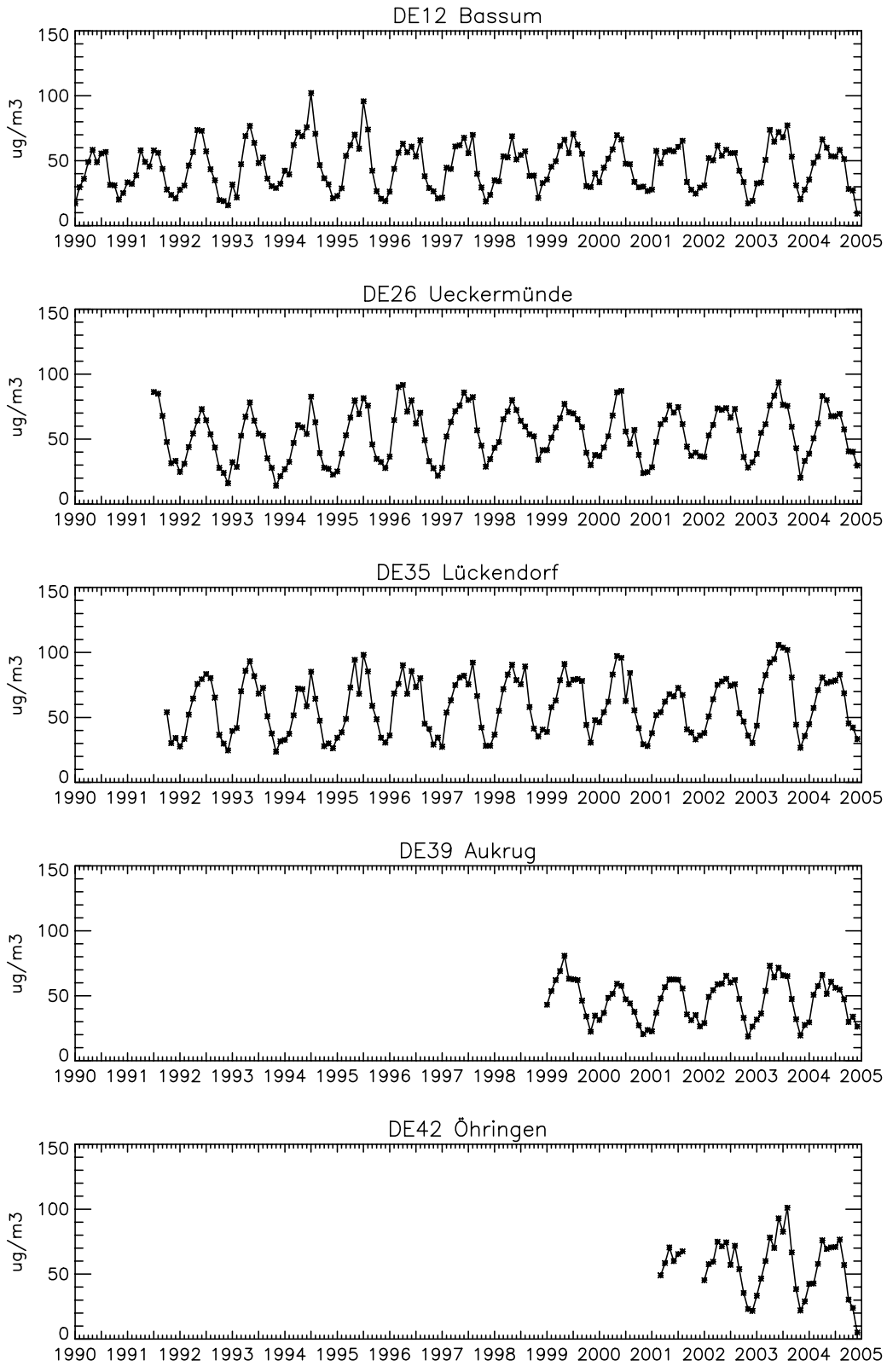

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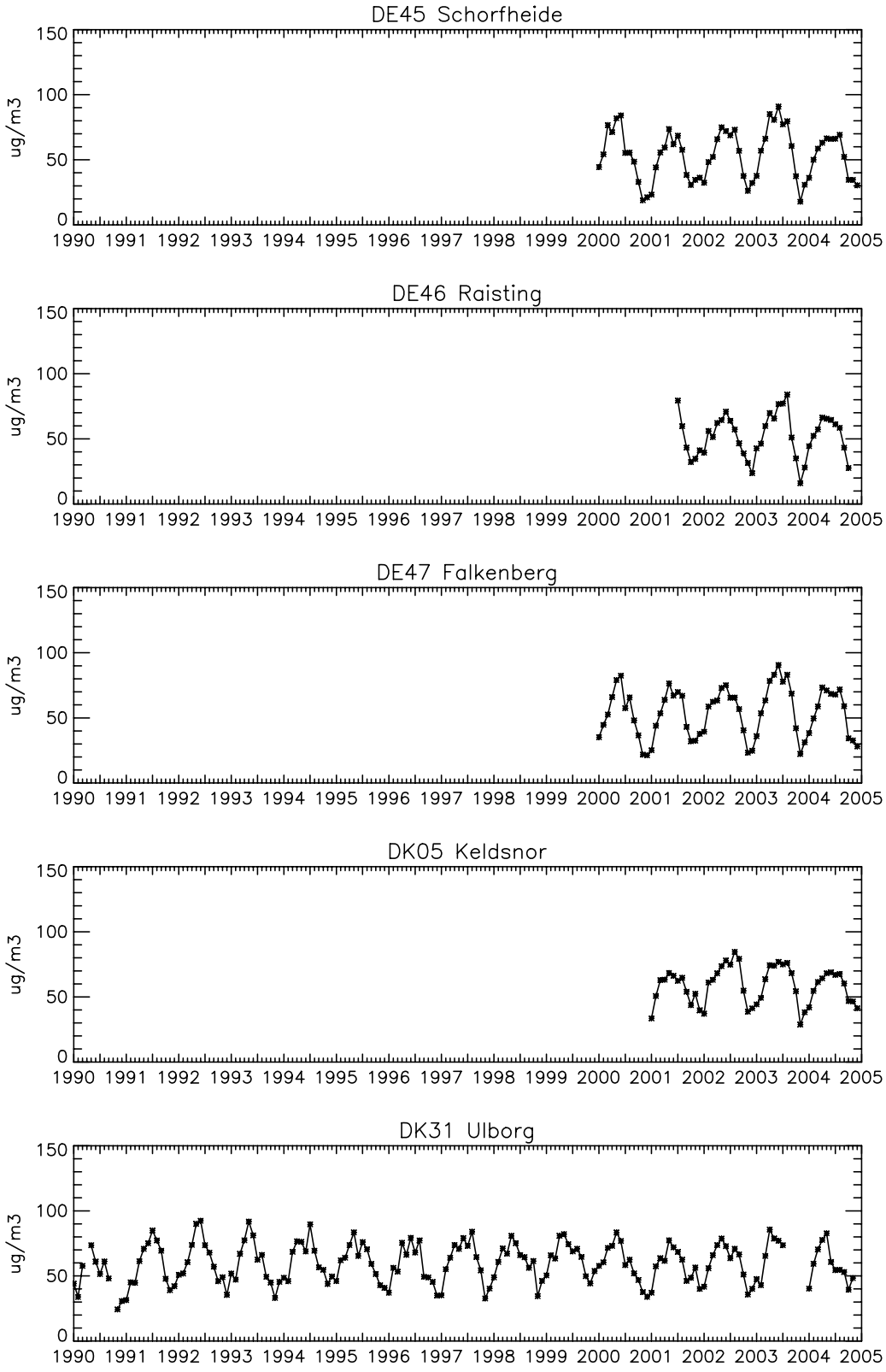

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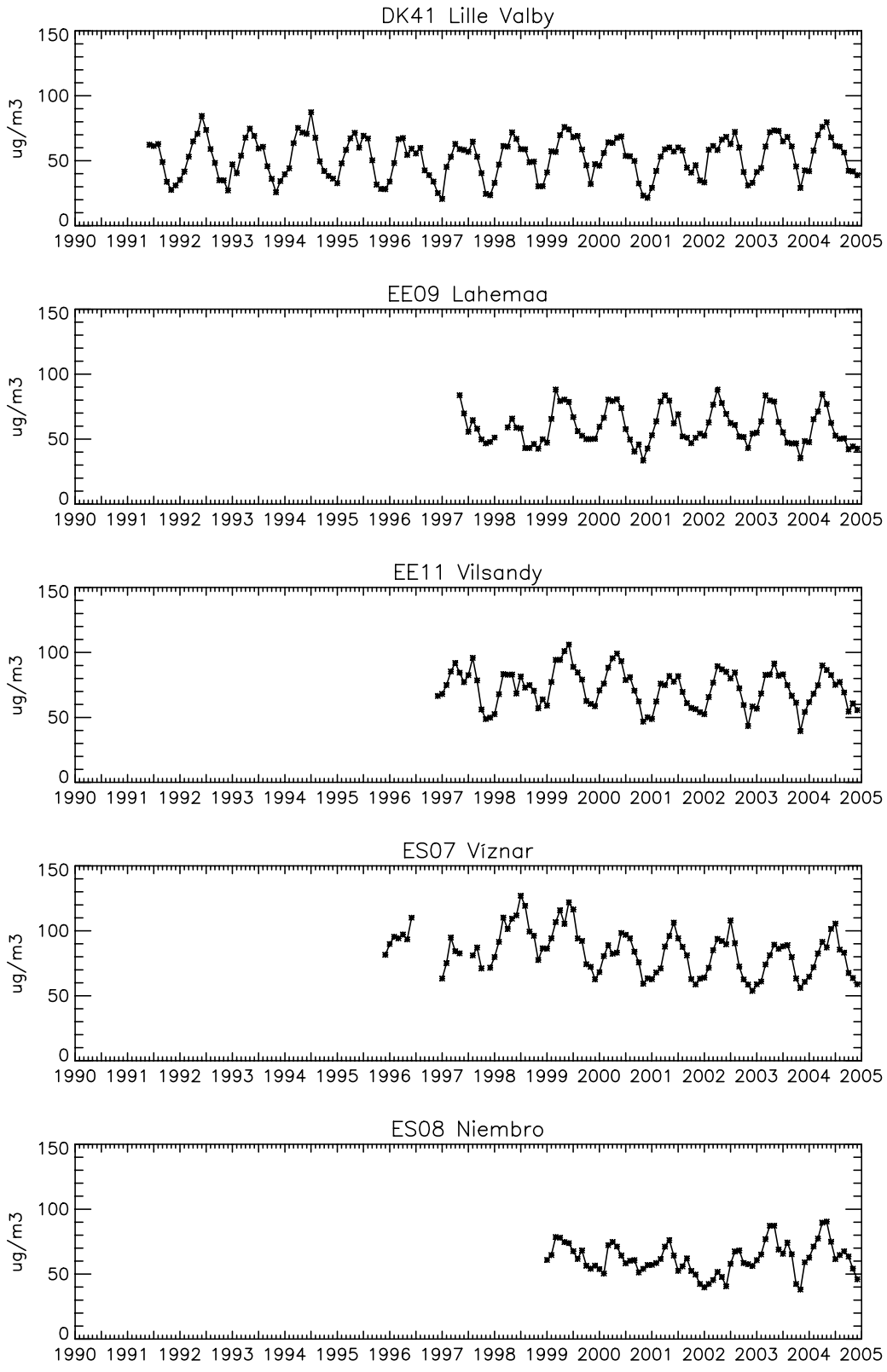

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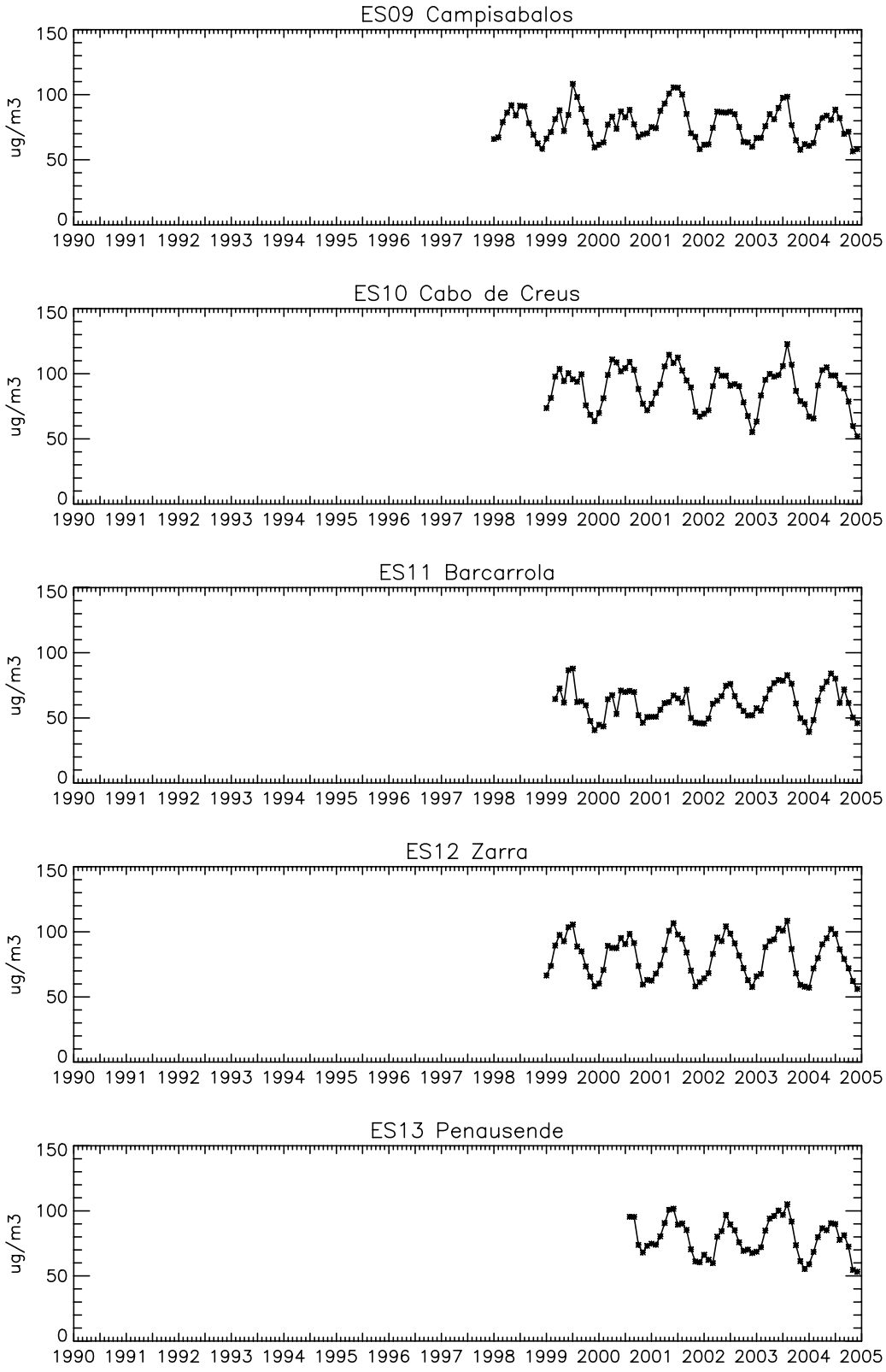

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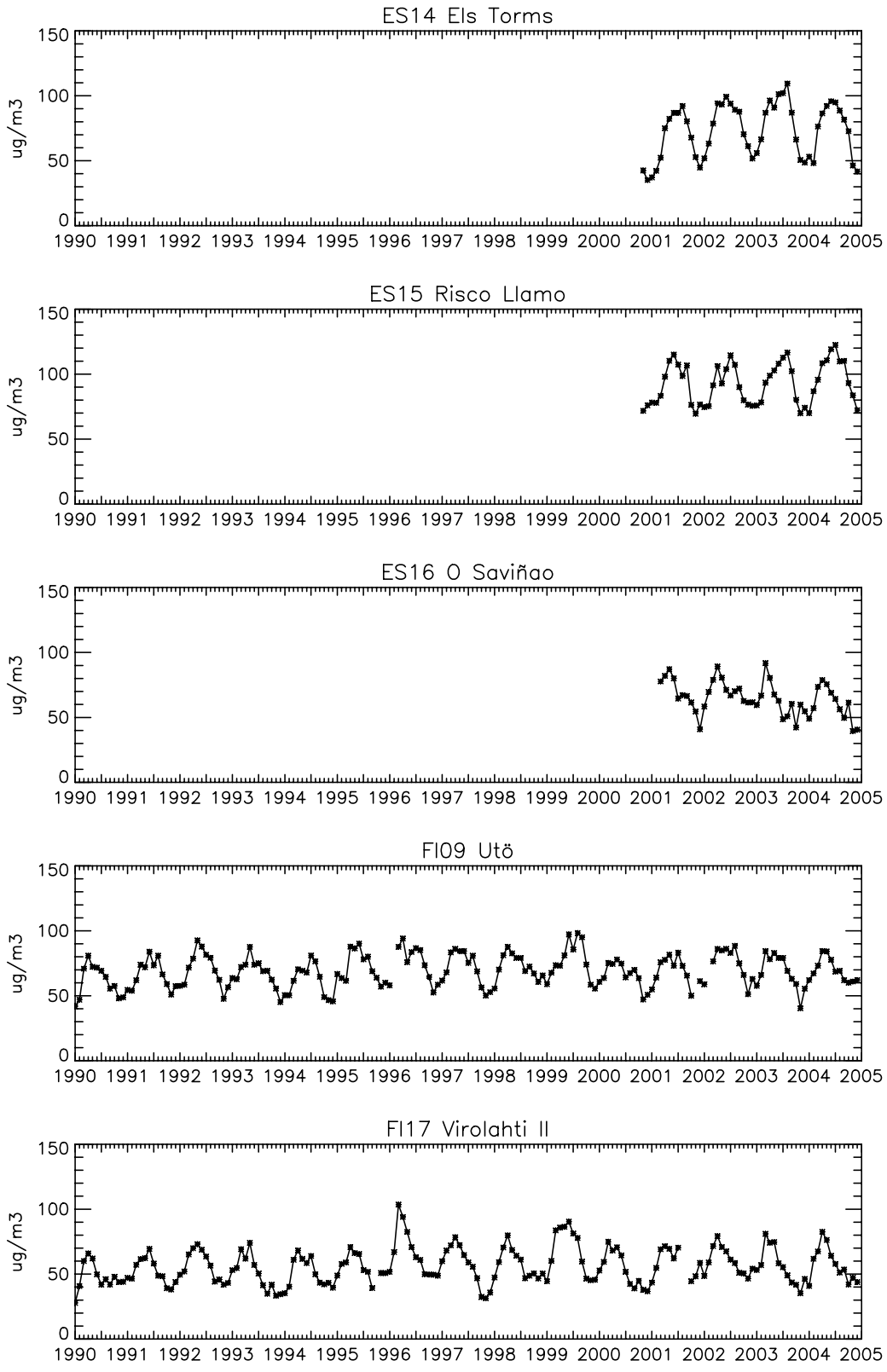

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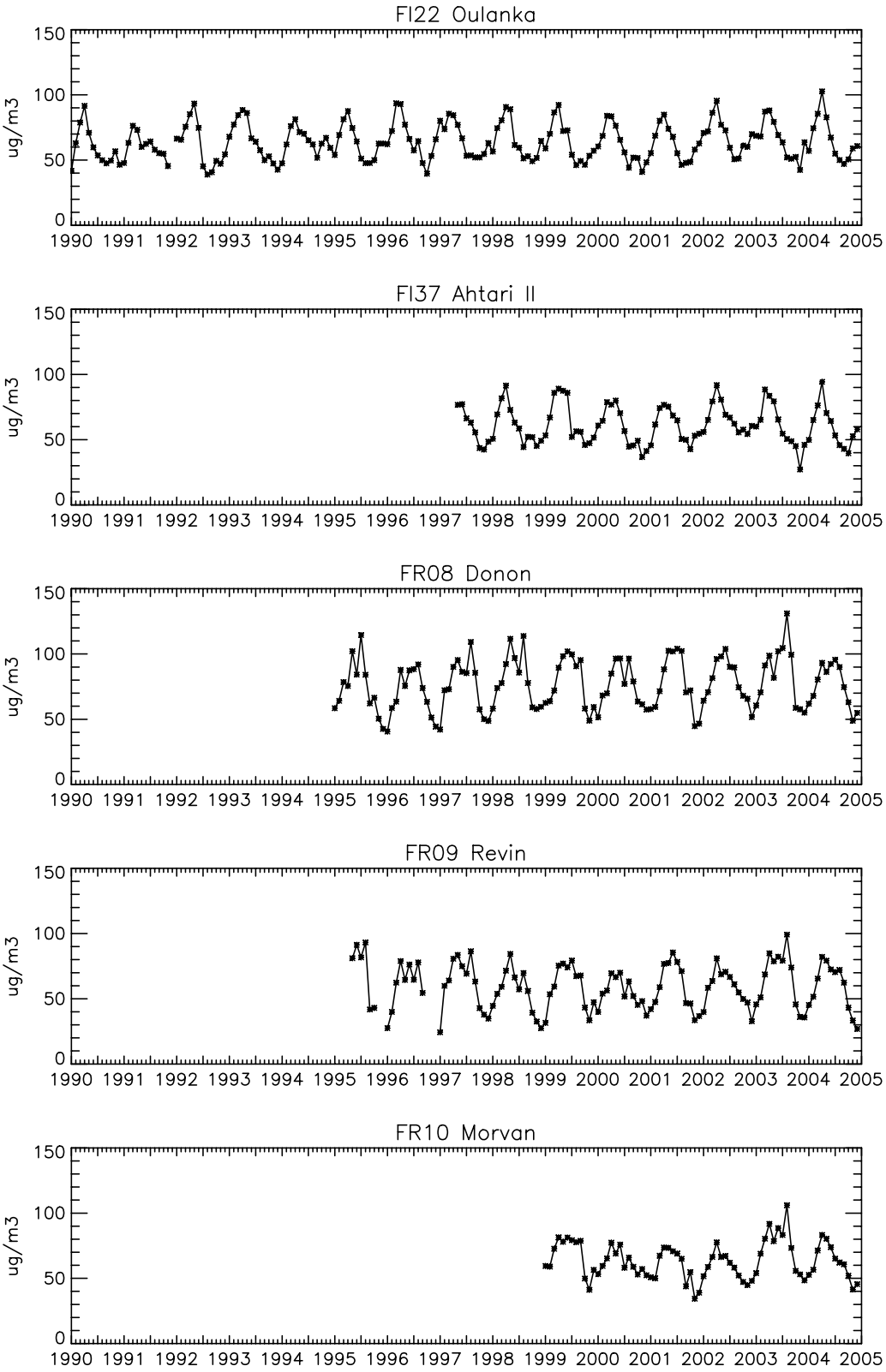

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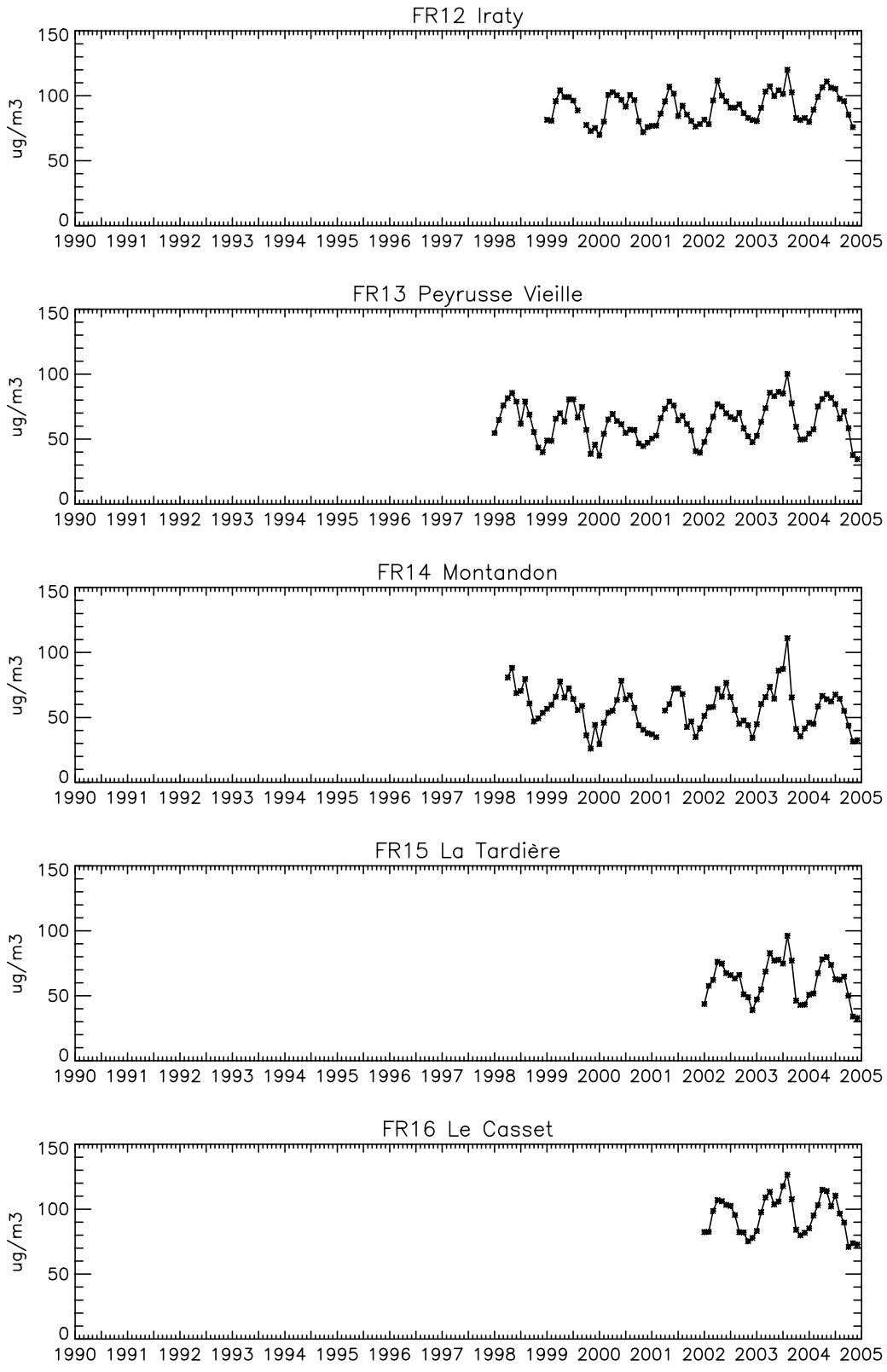

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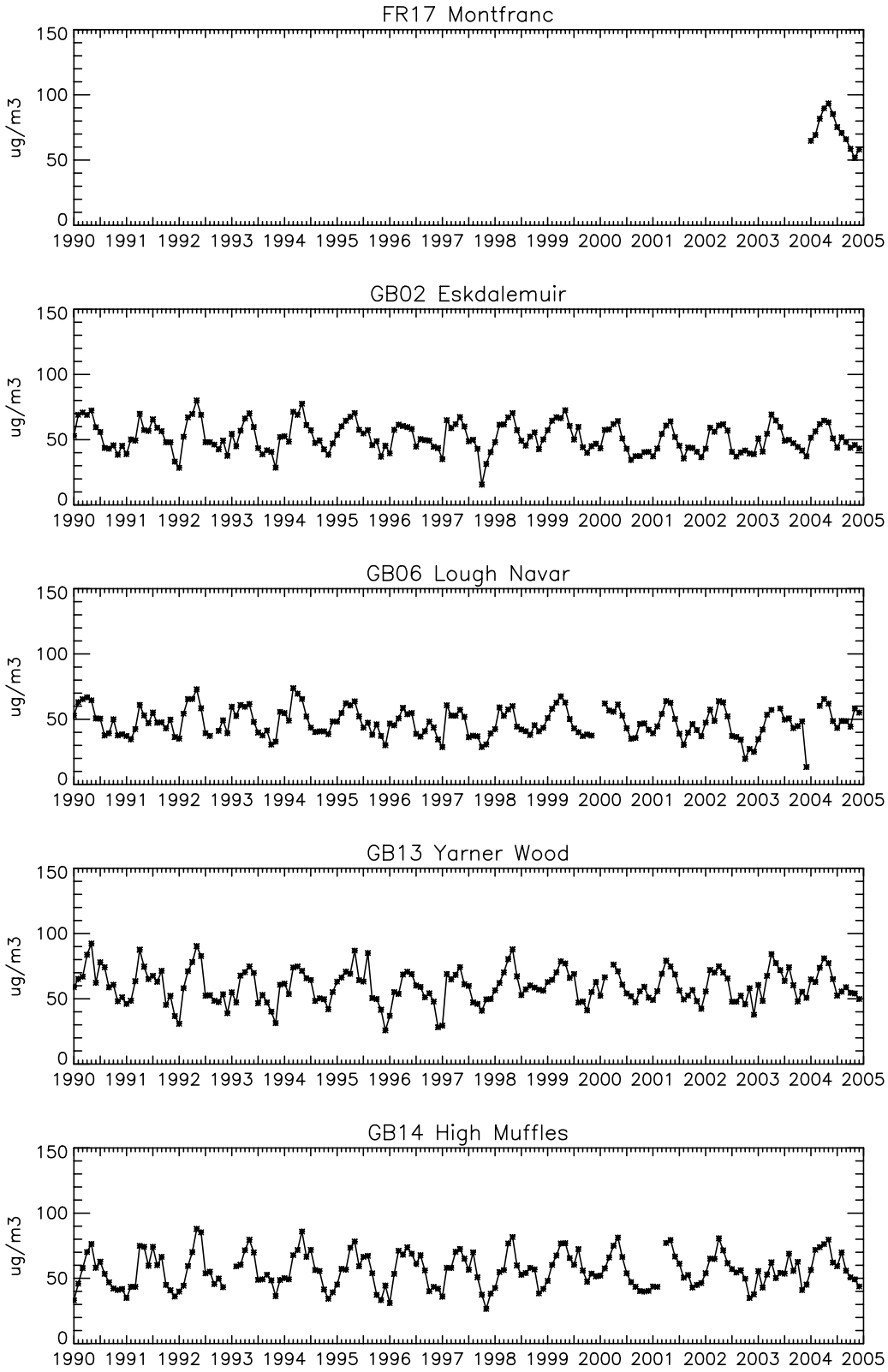

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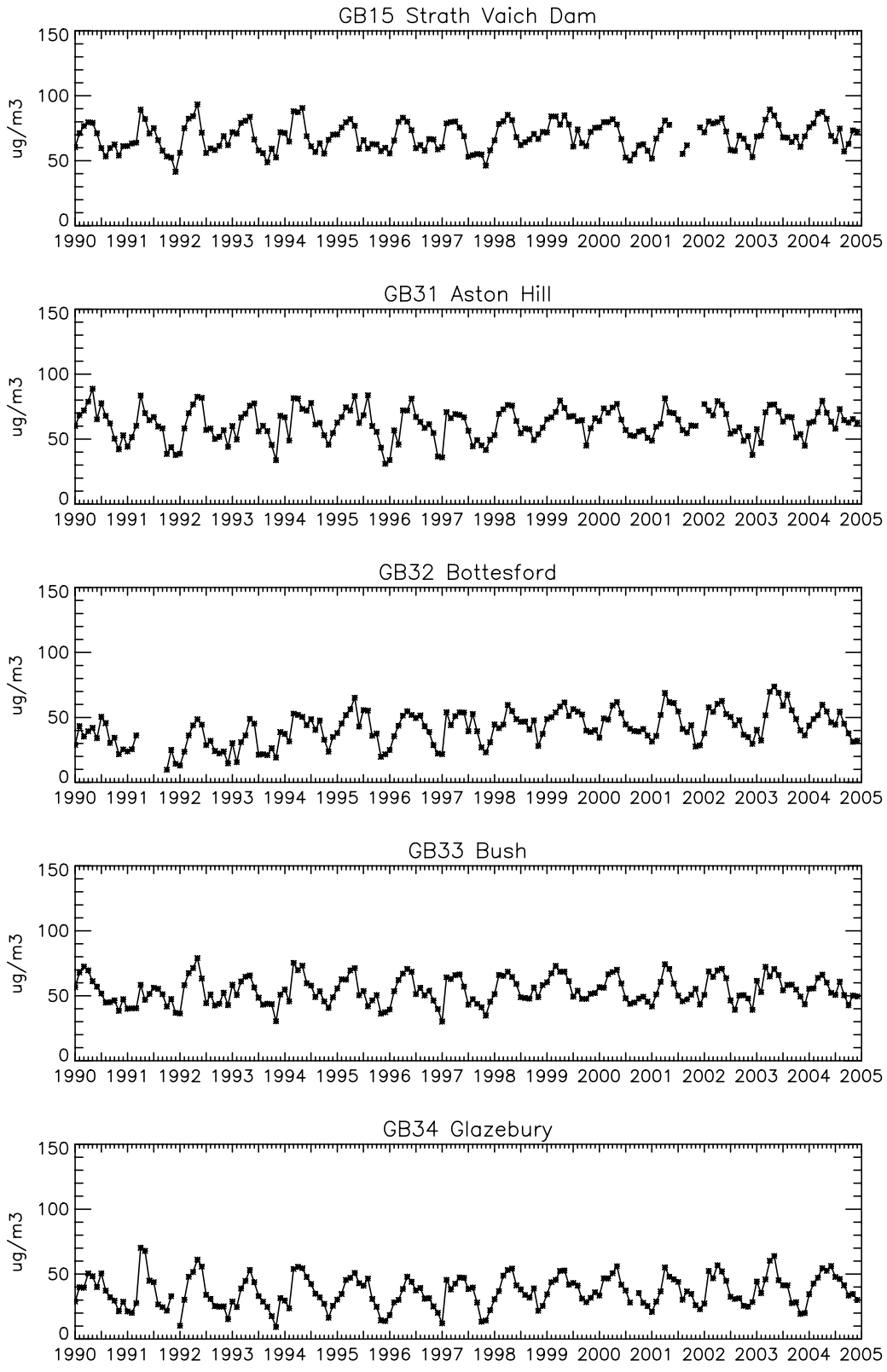

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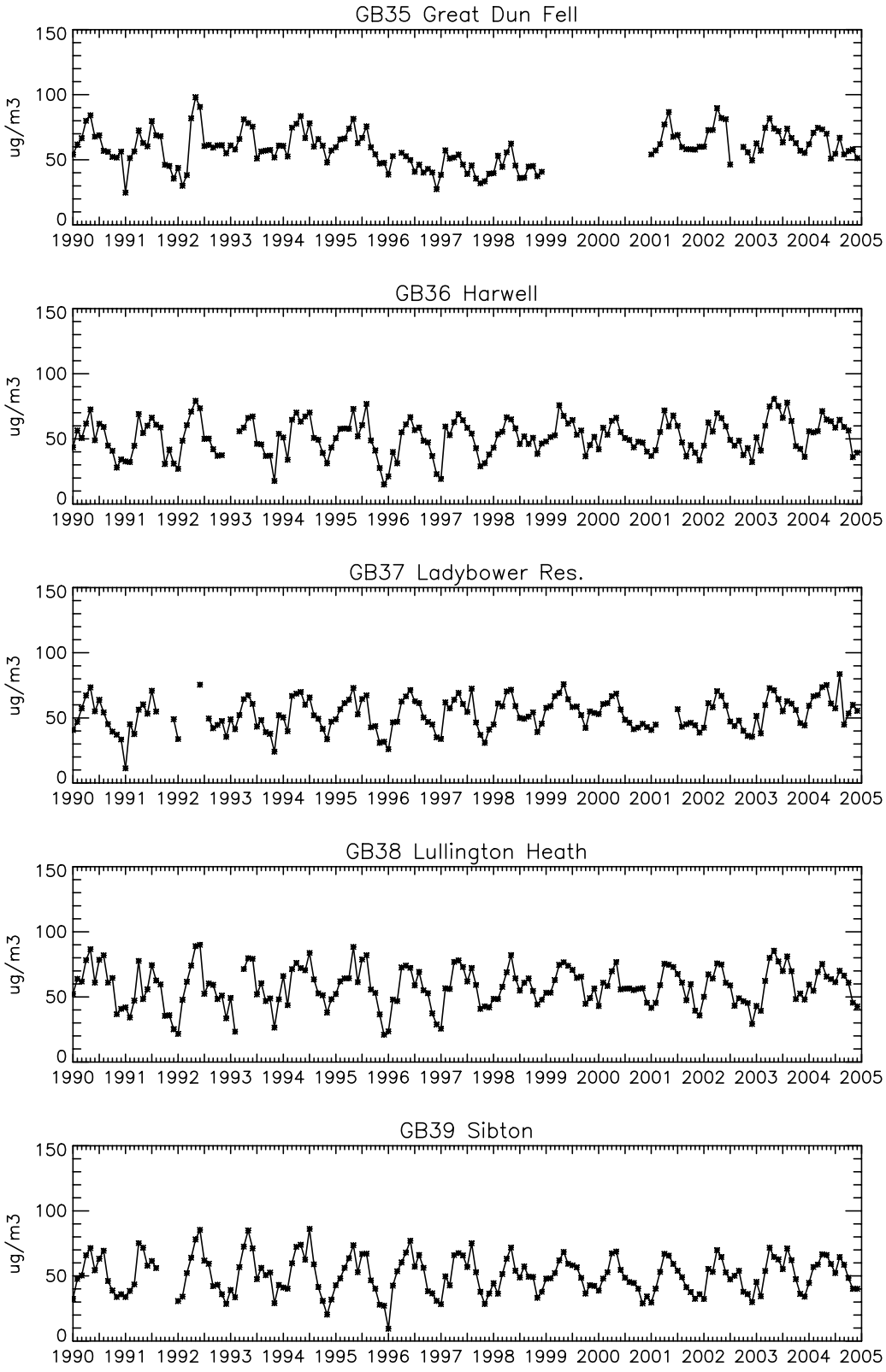

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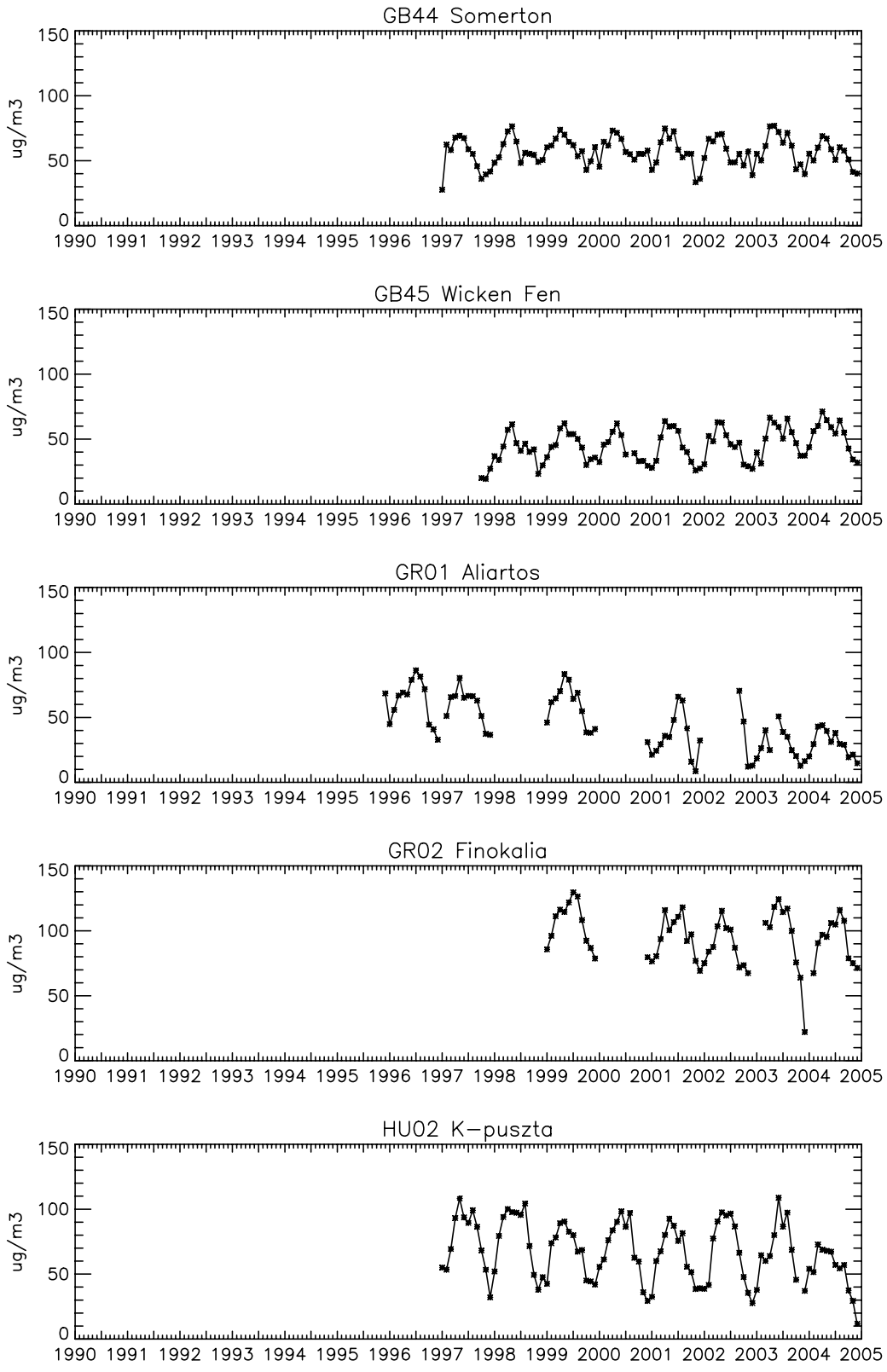

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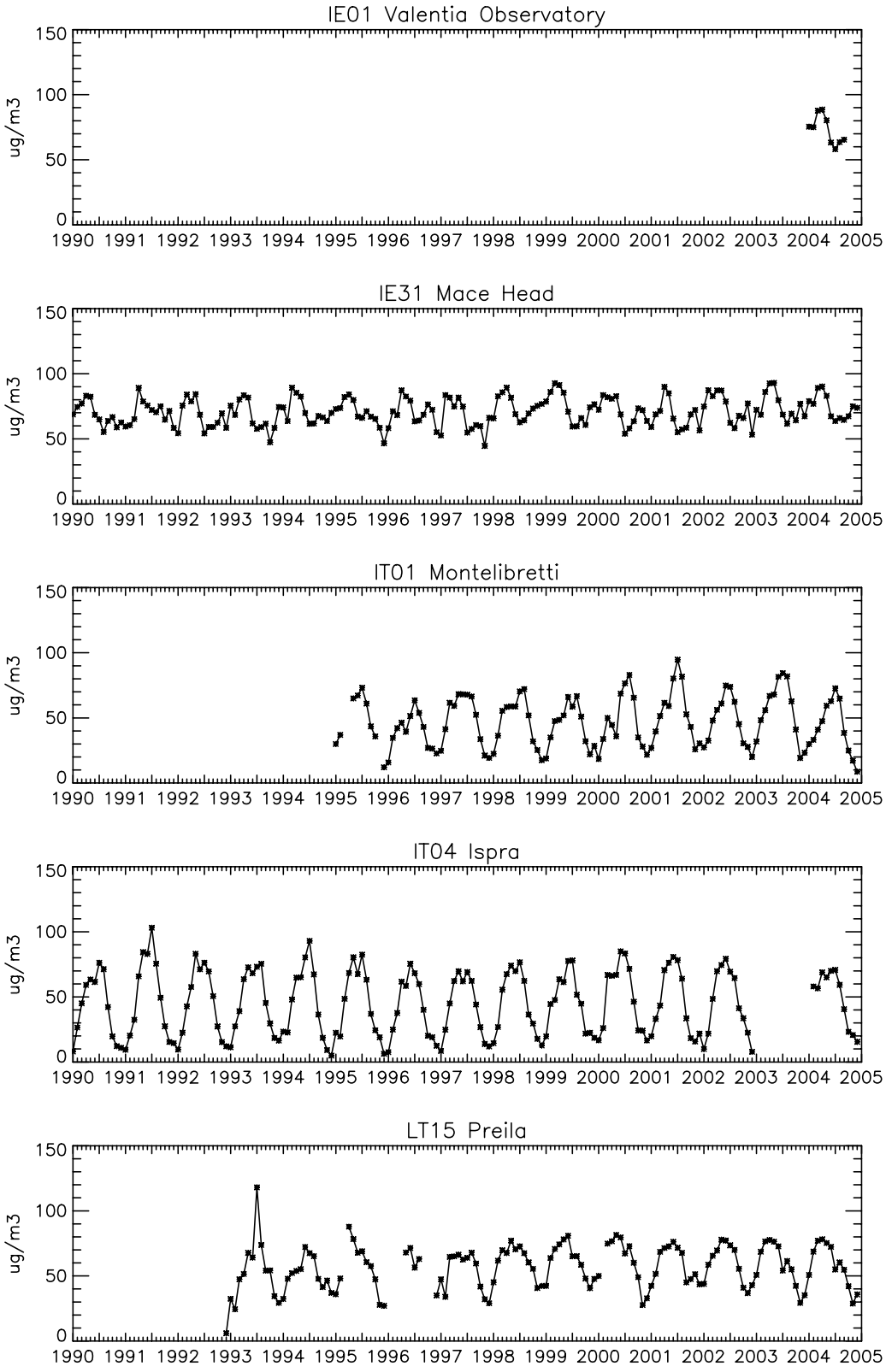

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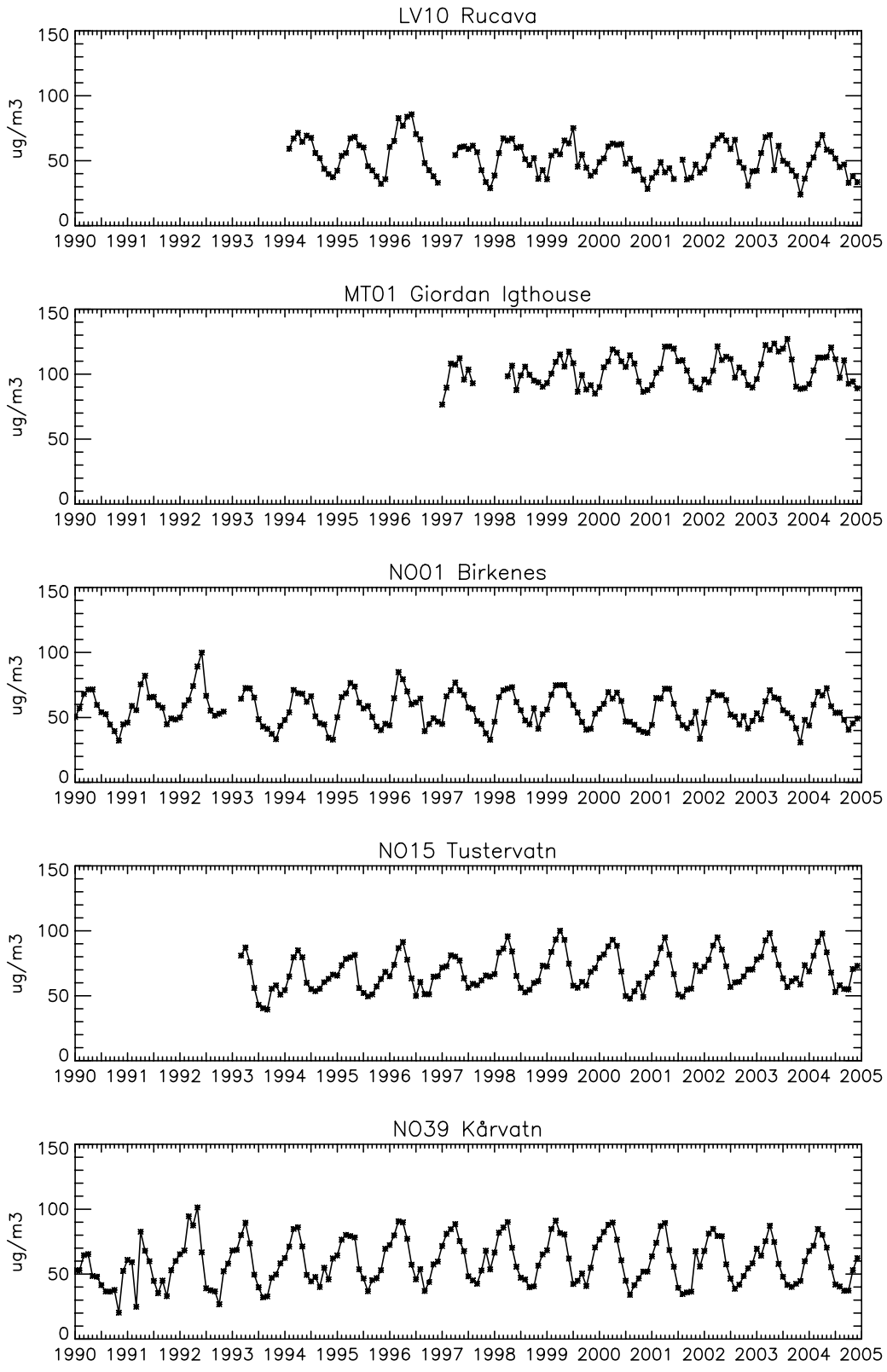

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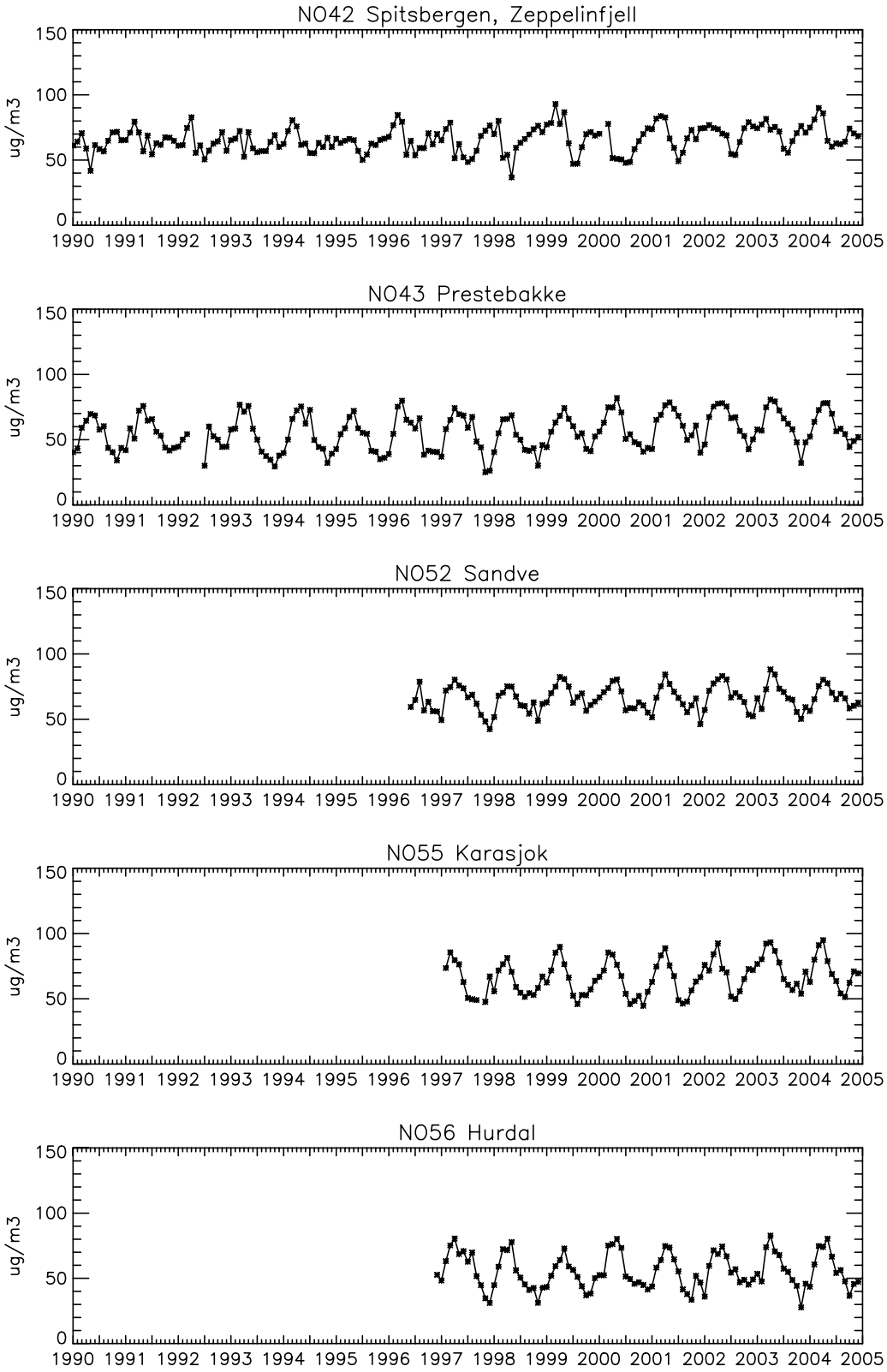

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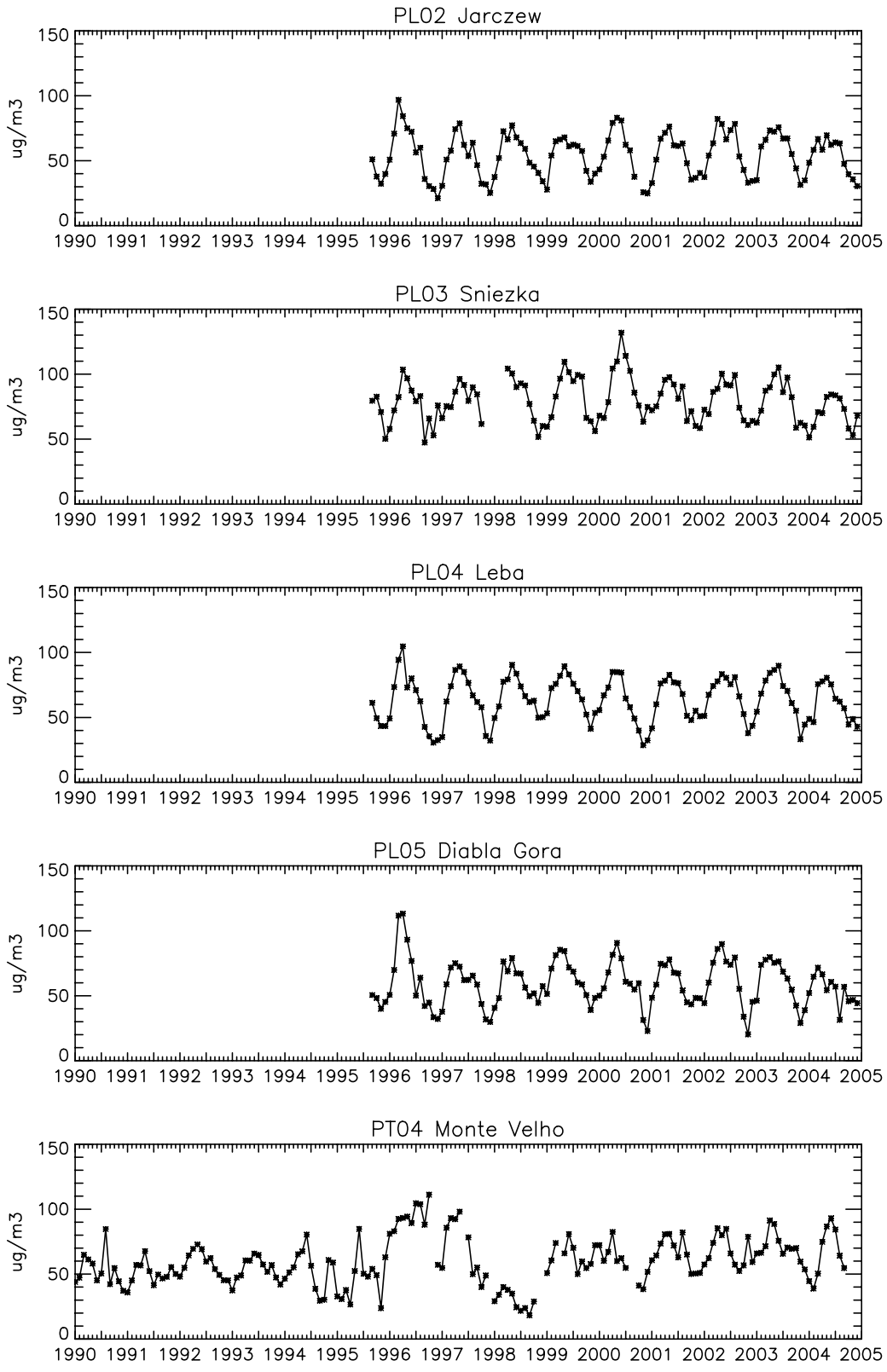

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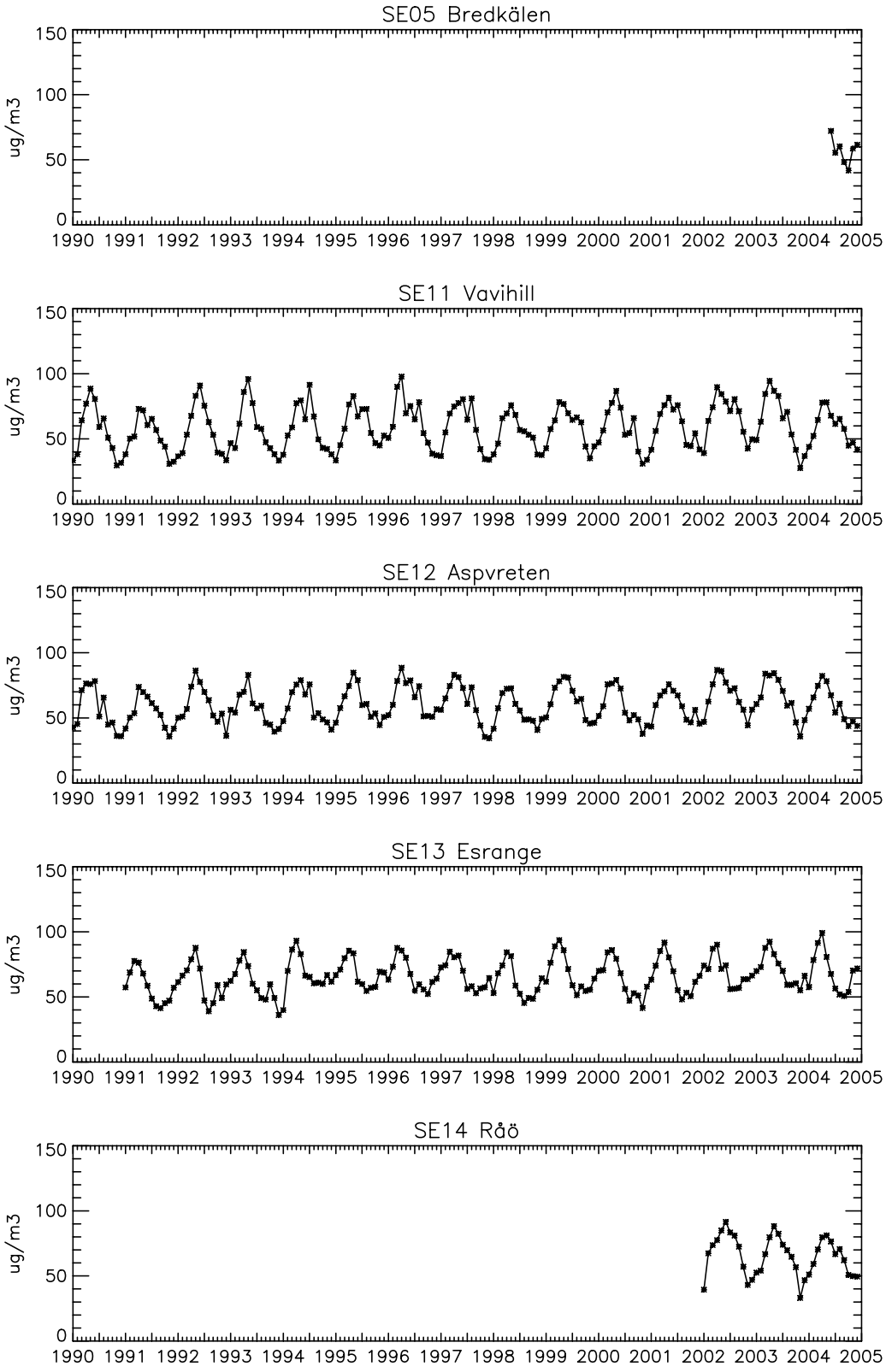

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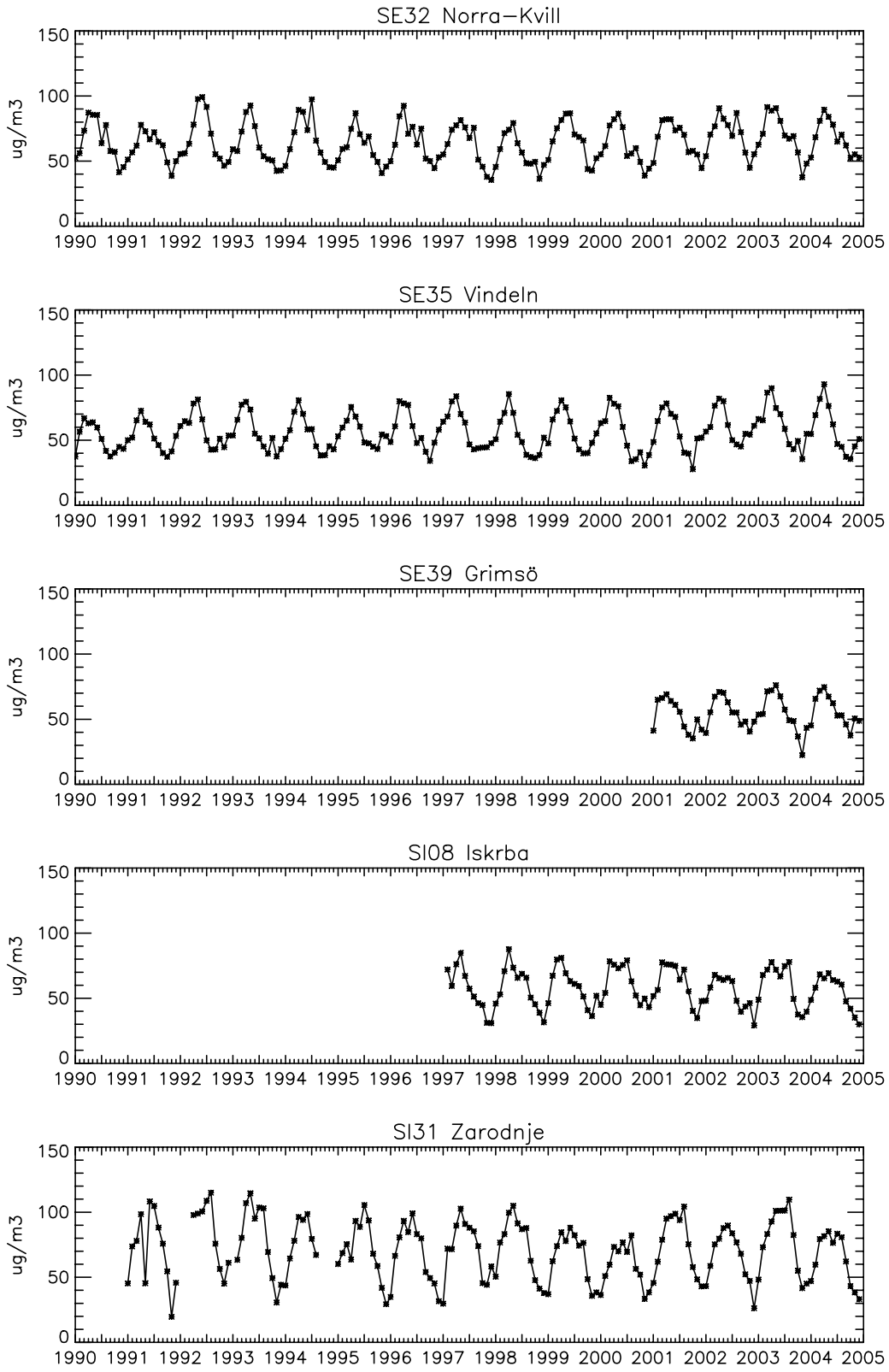

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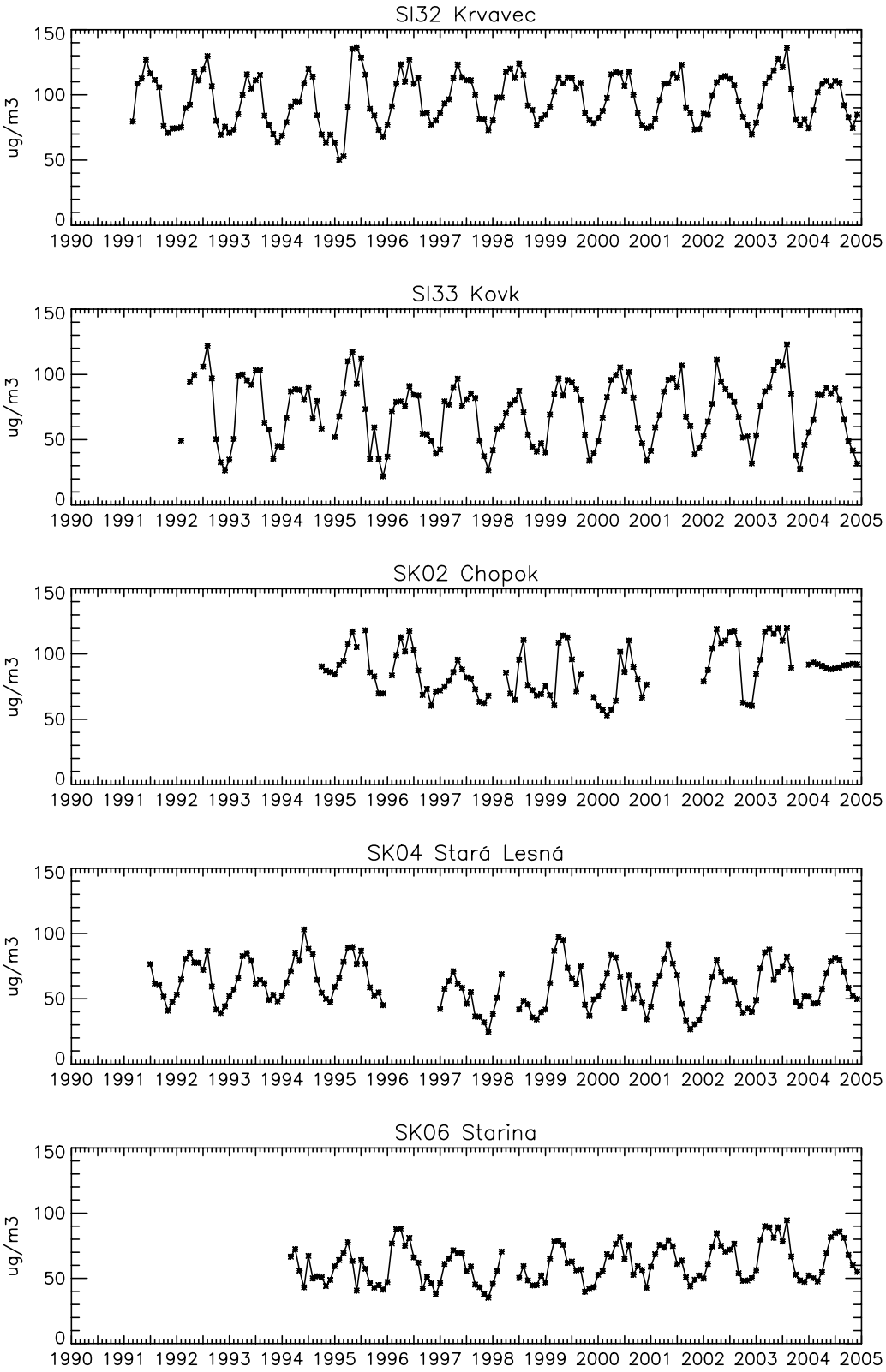

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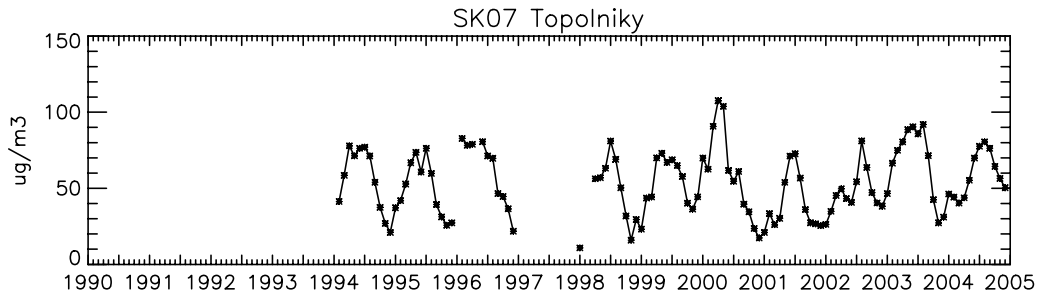


Figure 3.1, cont.

Annex 4

Diurnal variation, April–September 2004

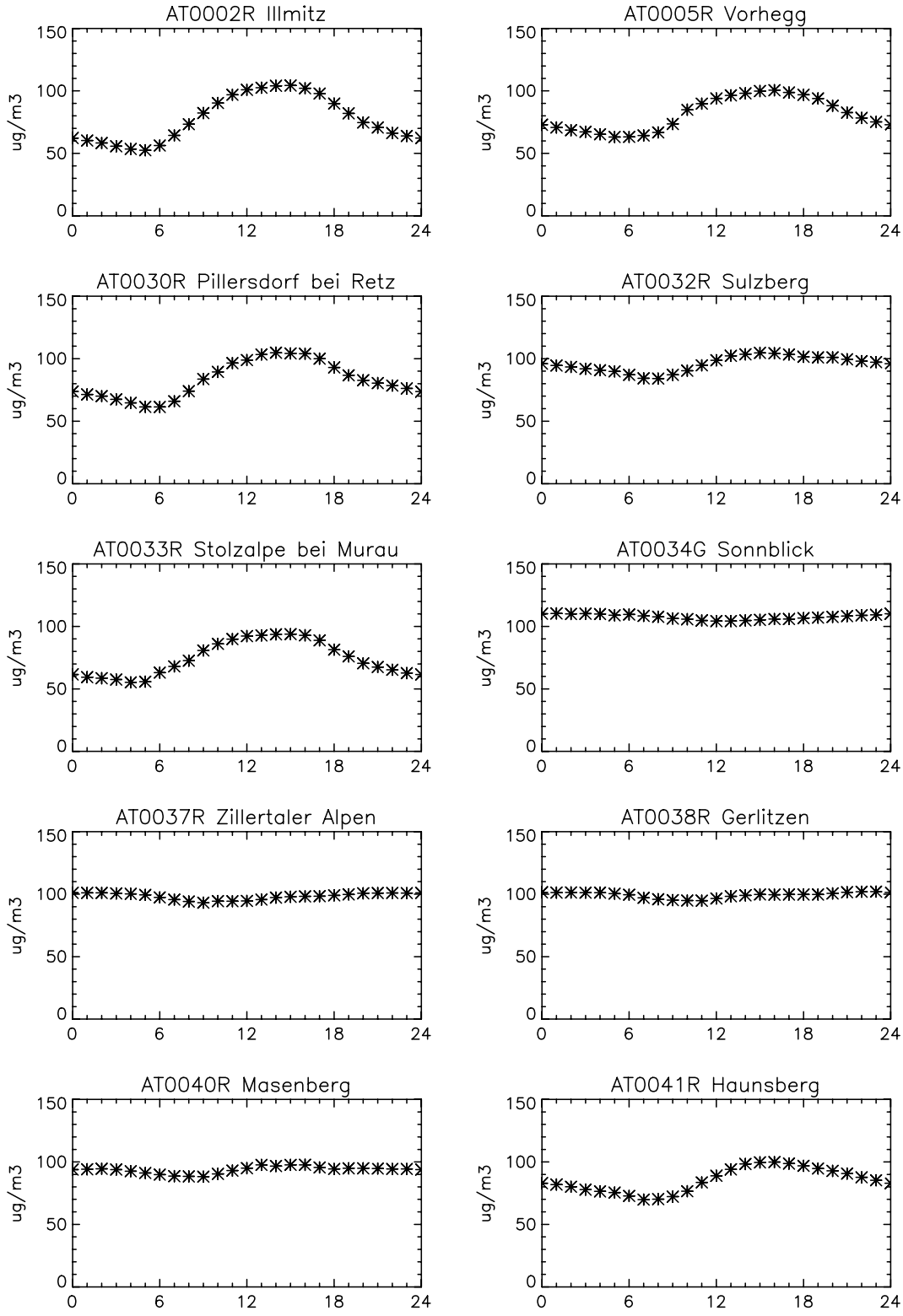
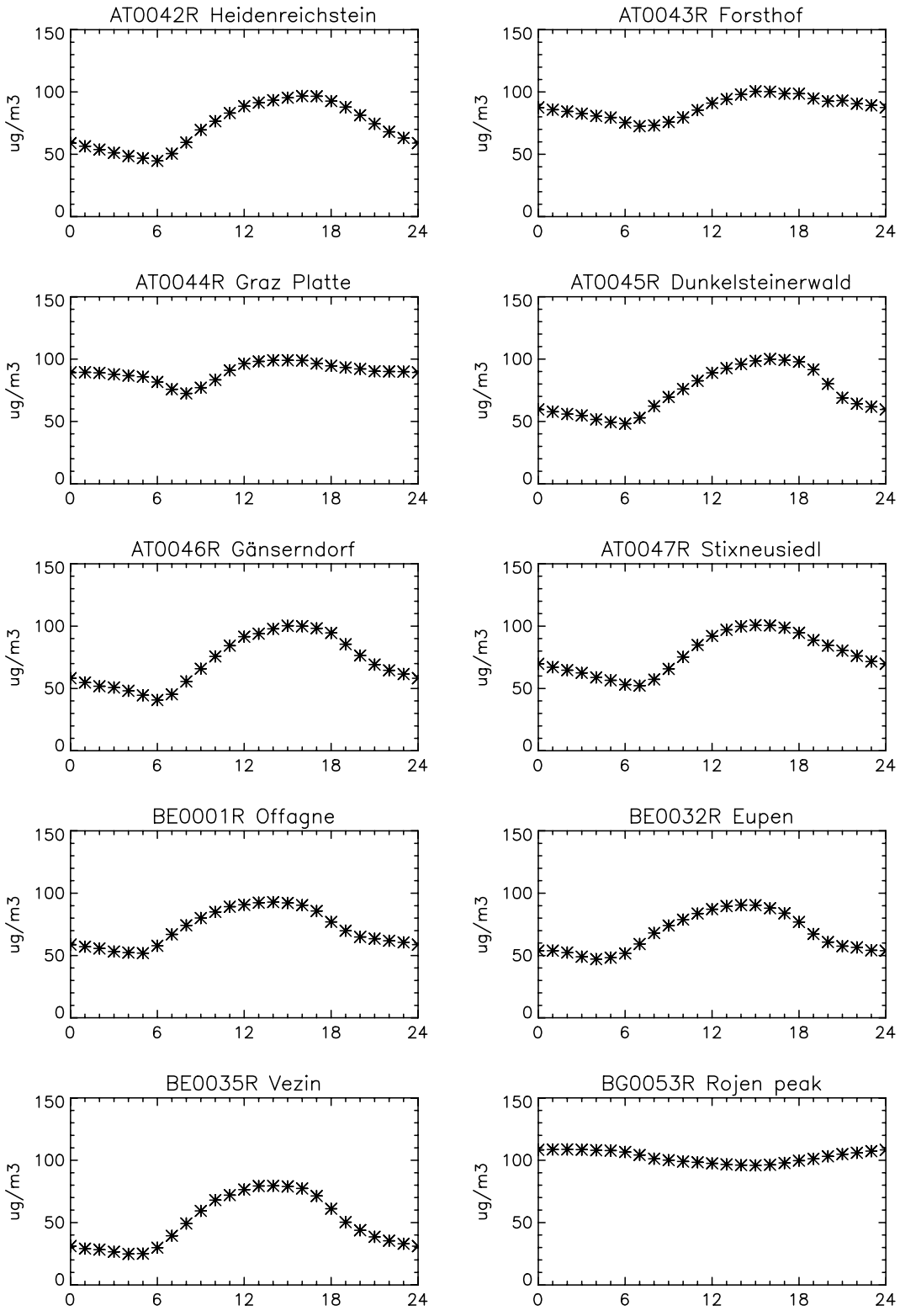


Figure 4.1: Diurnal variation, April–September 2004.



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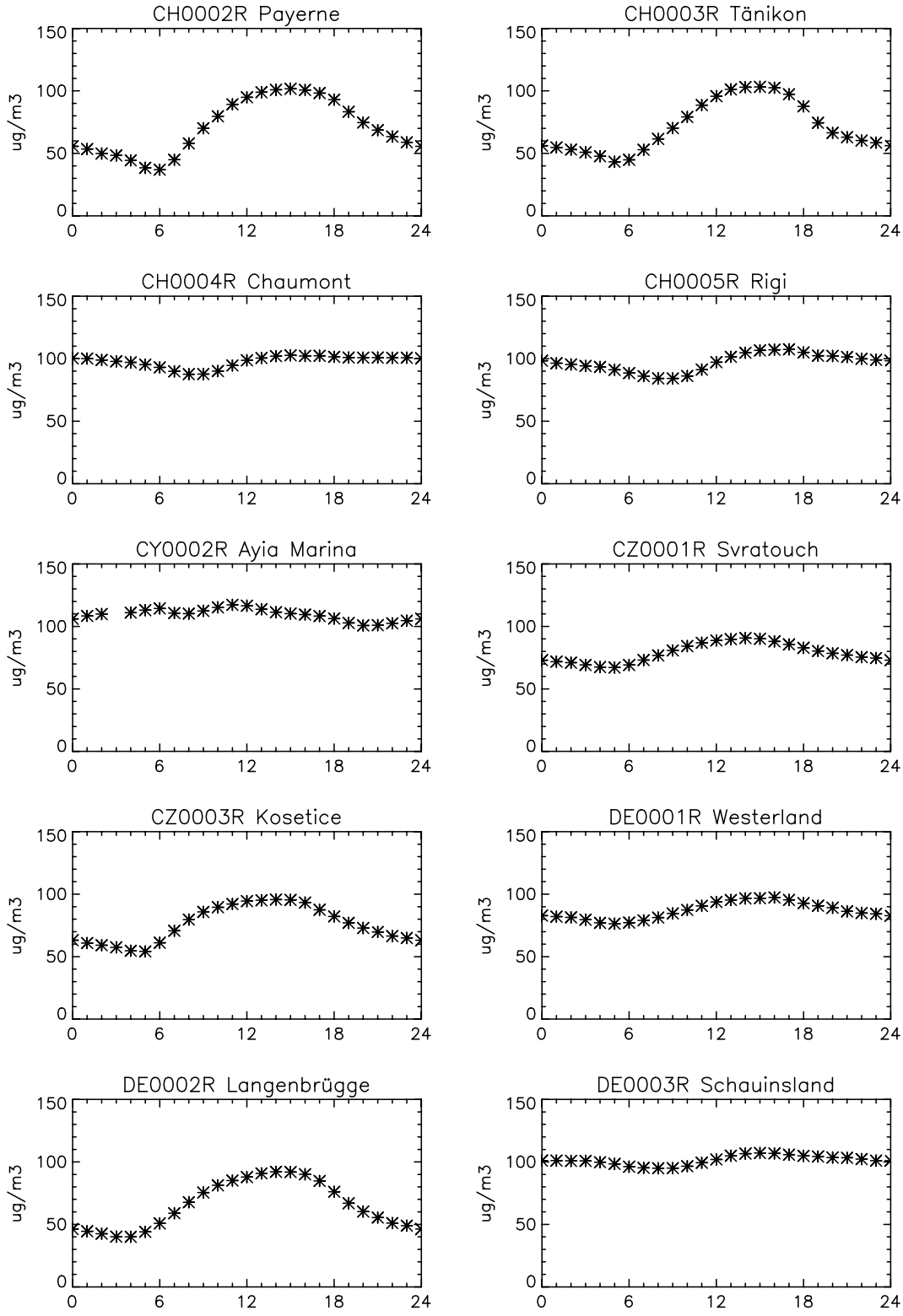

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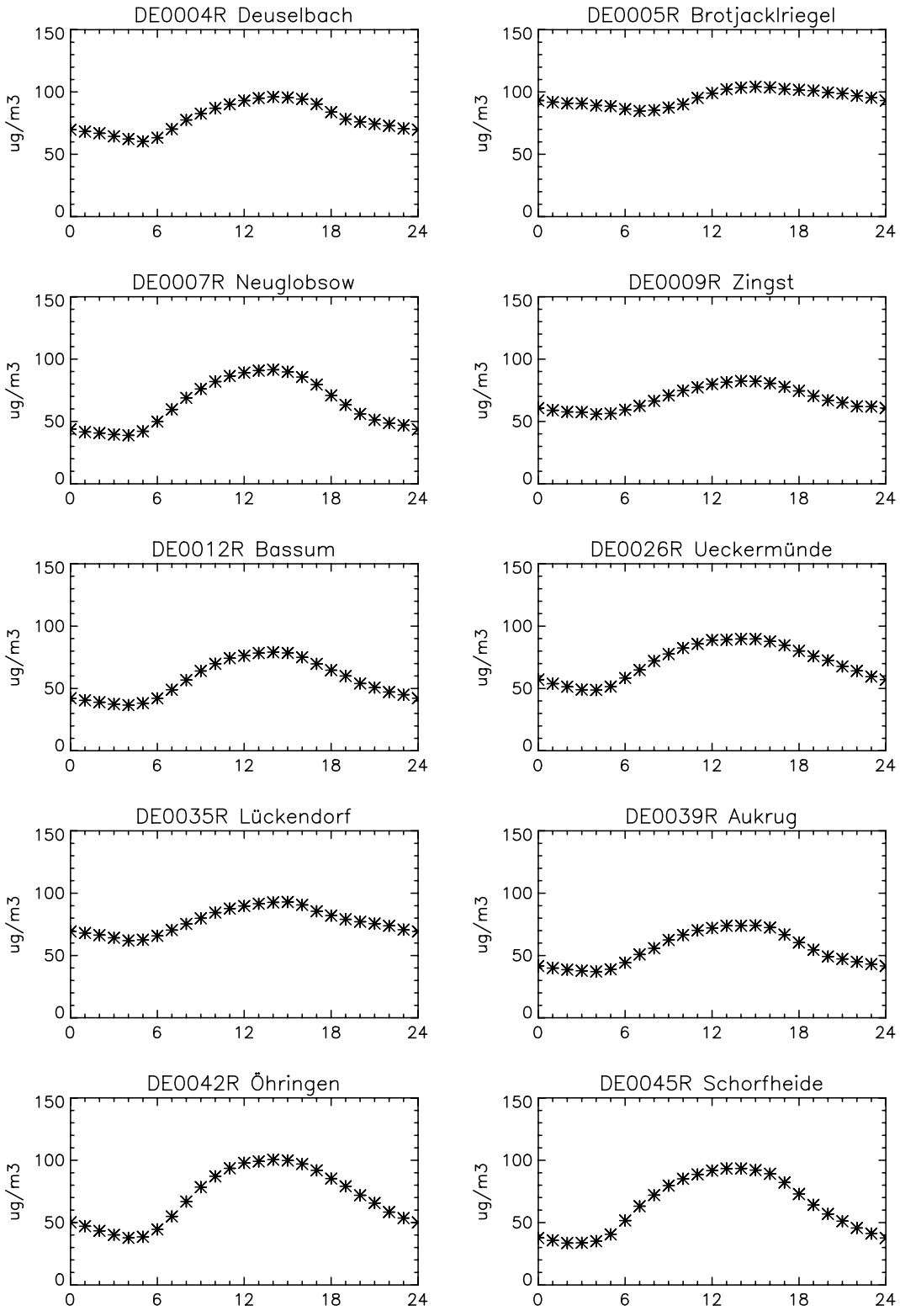

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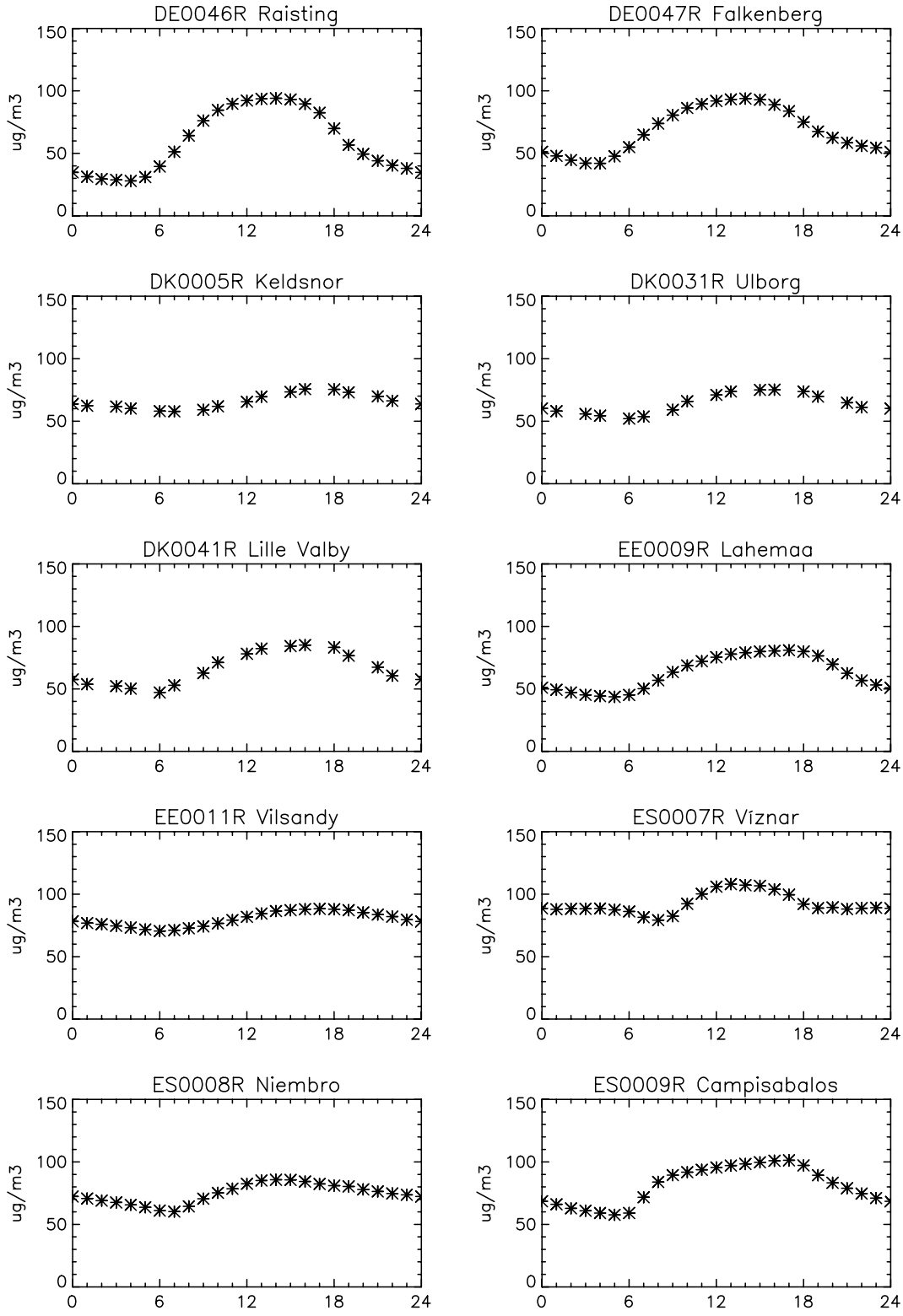

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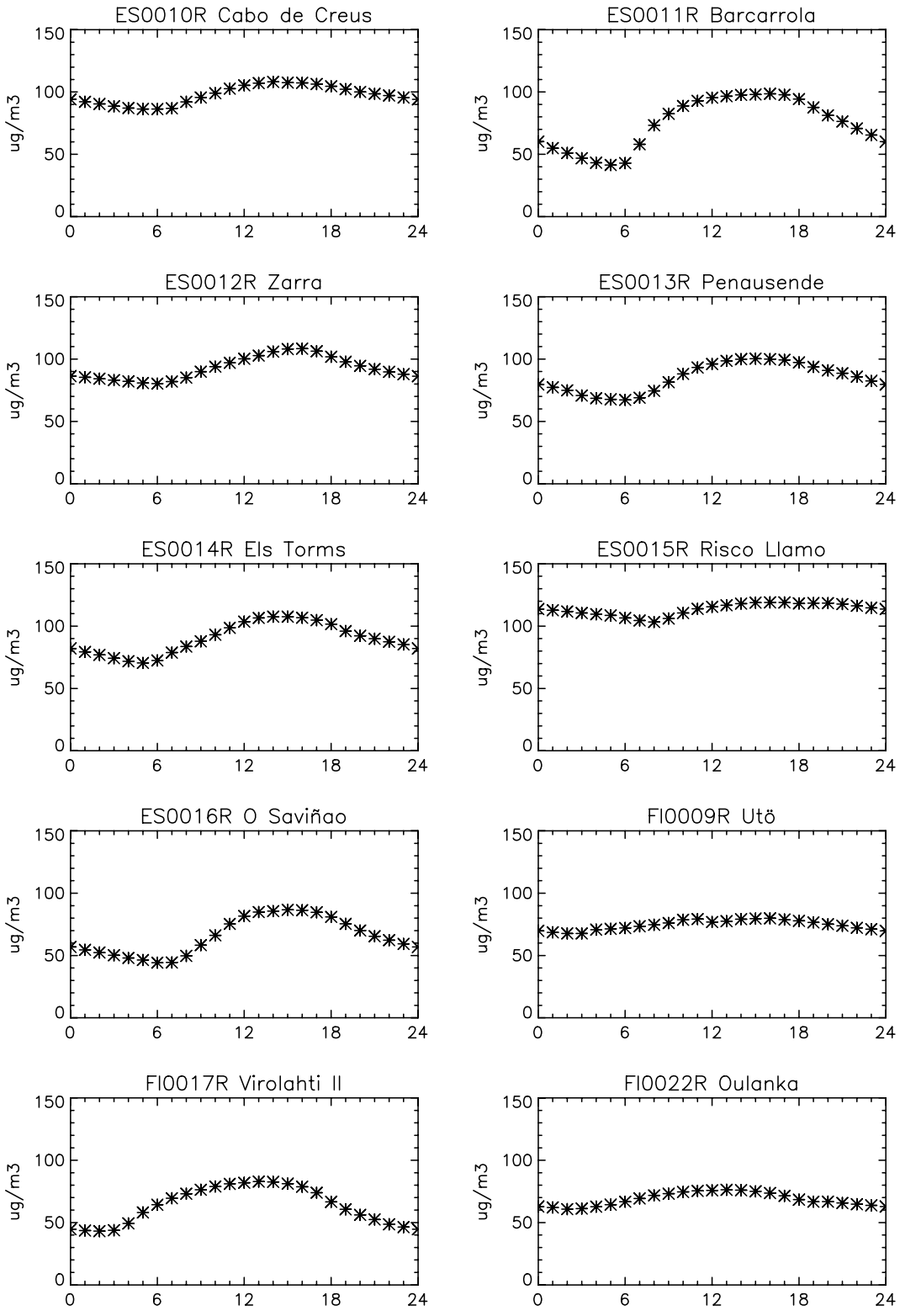

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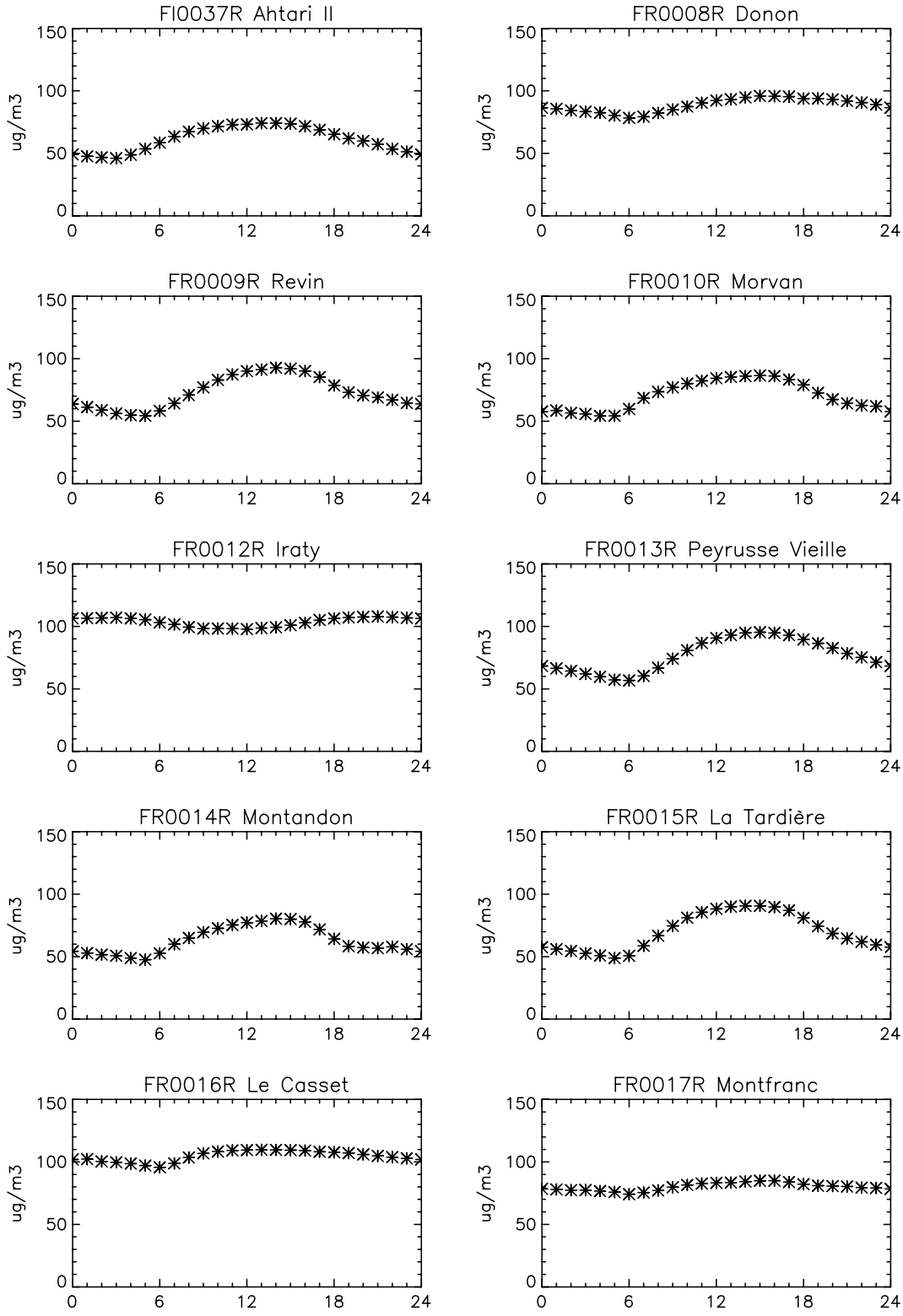

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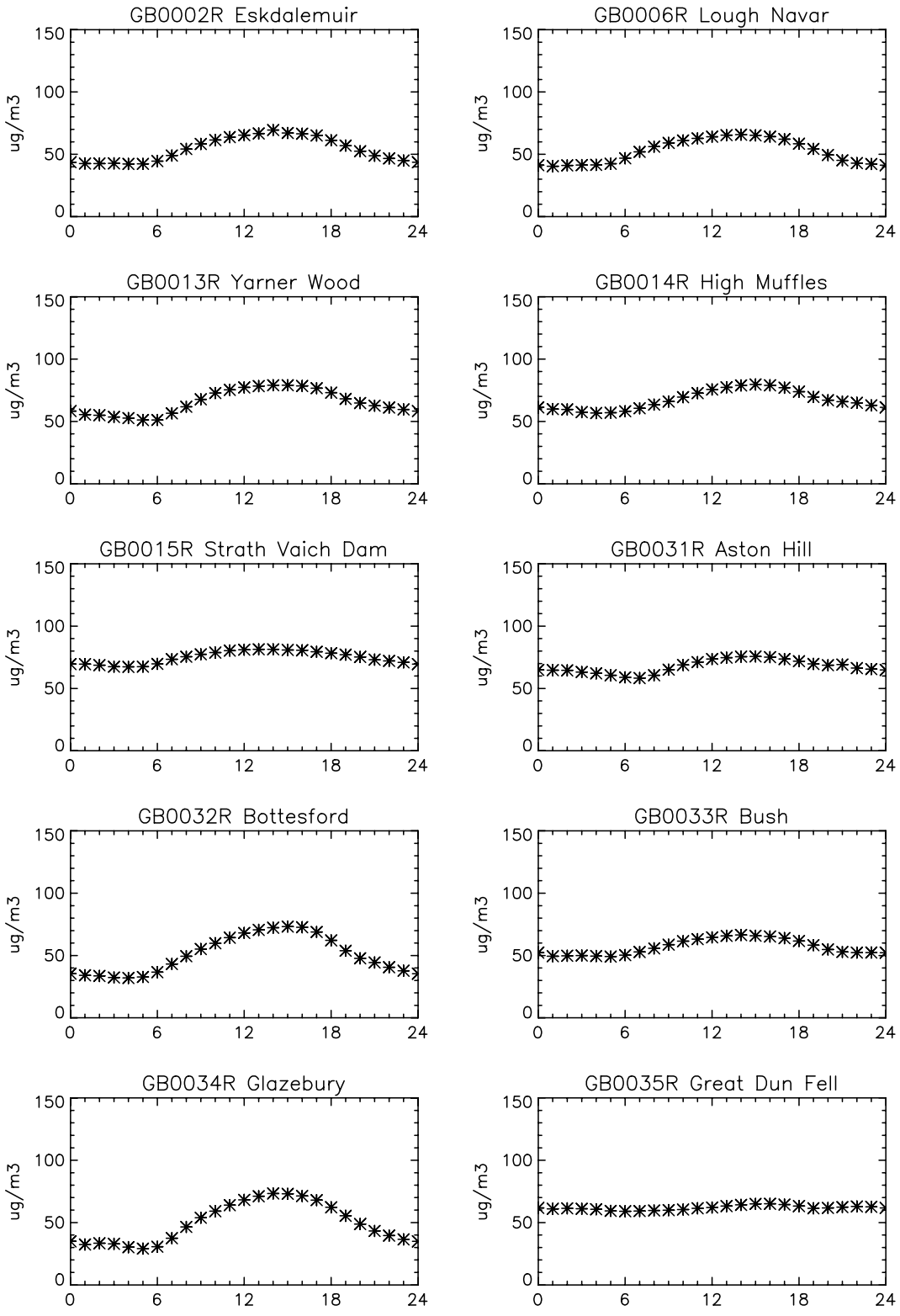

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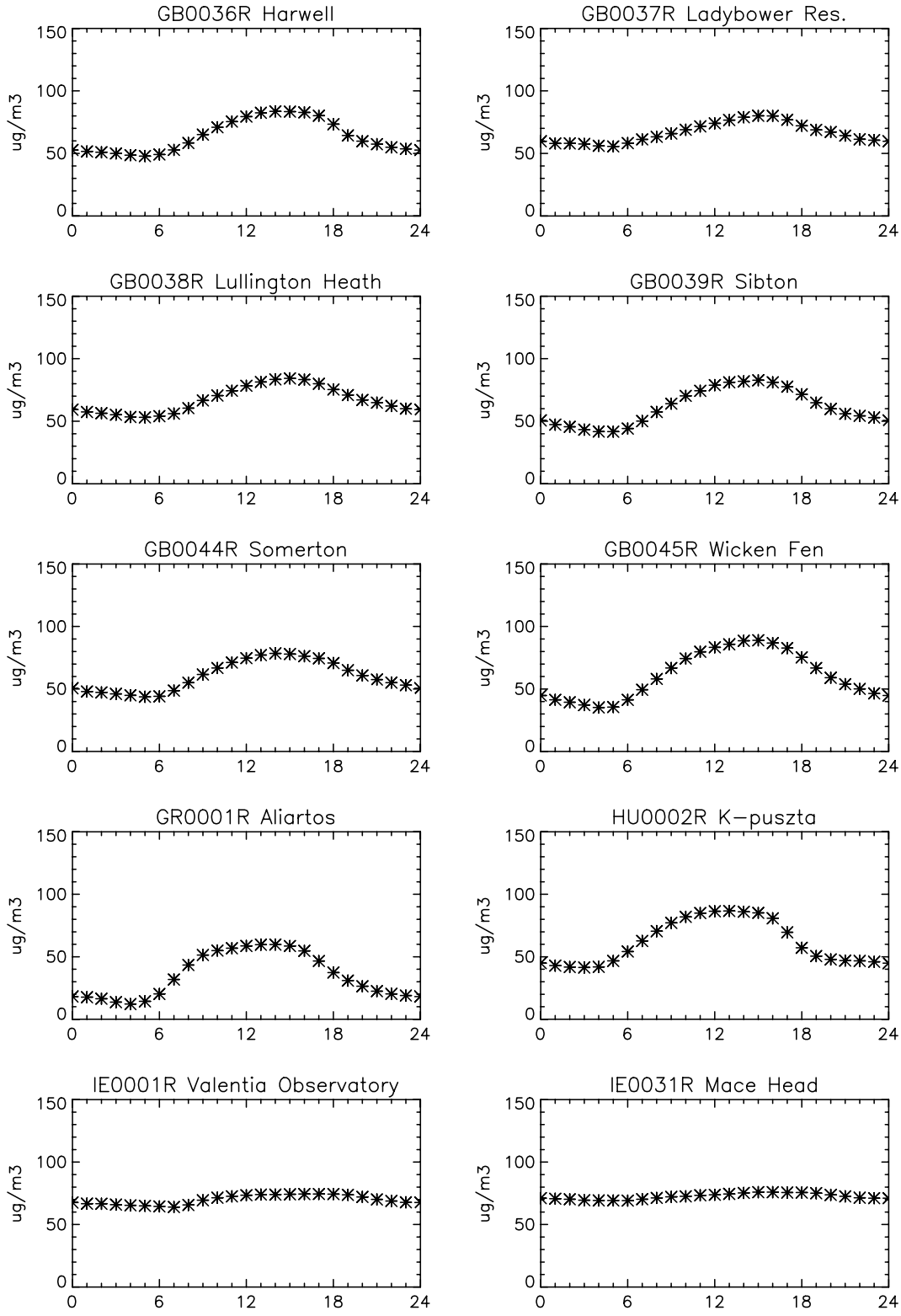

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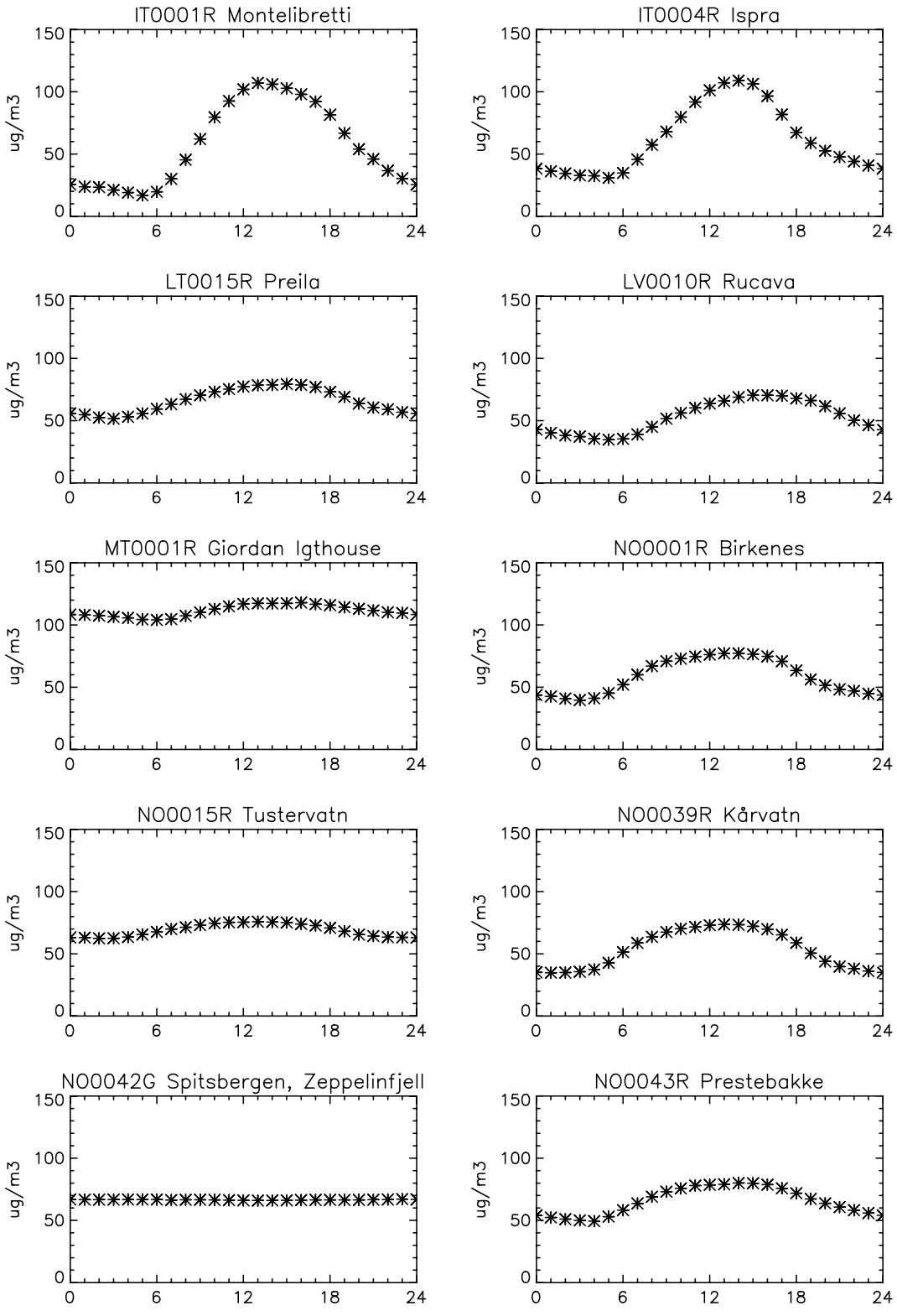

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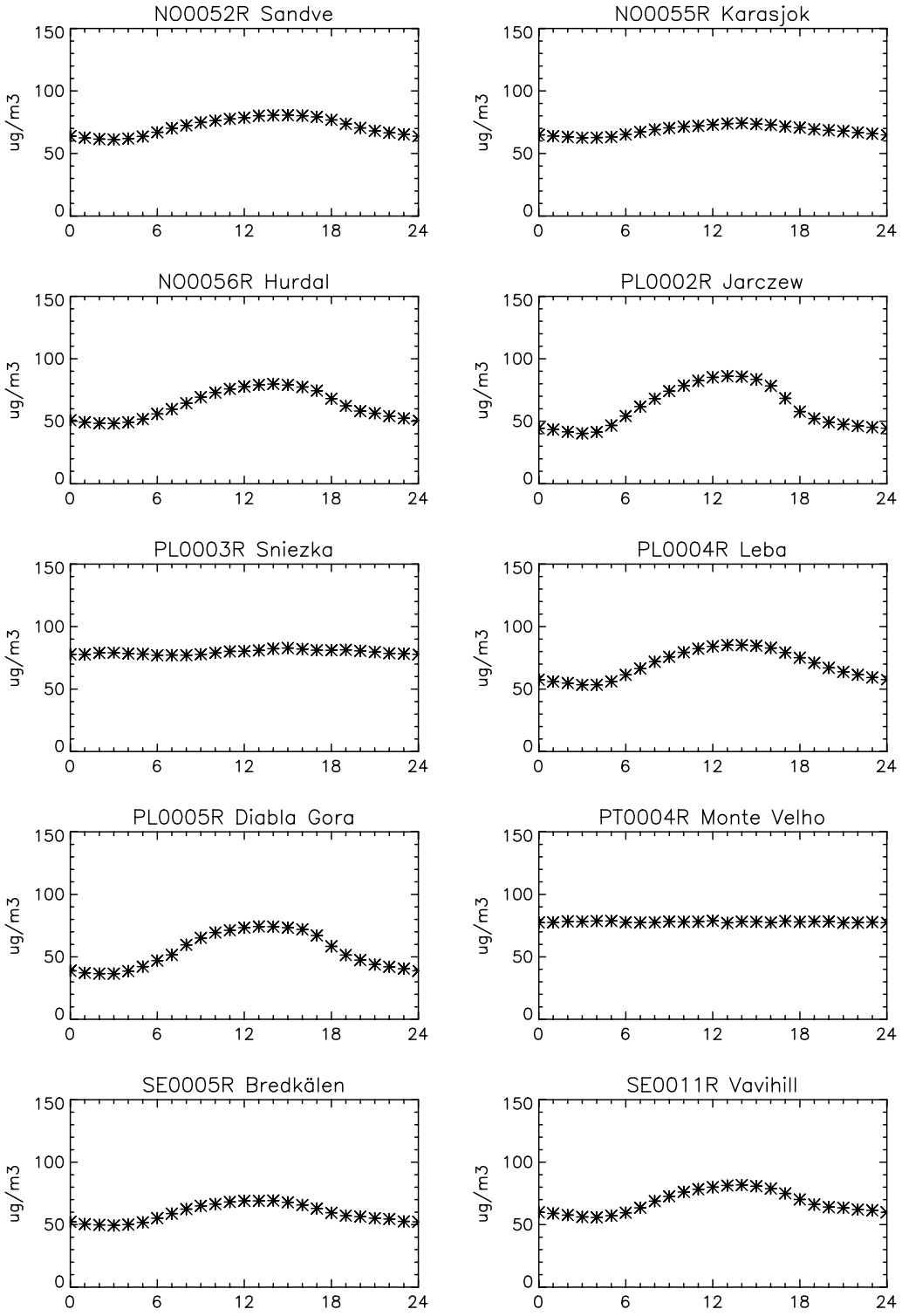

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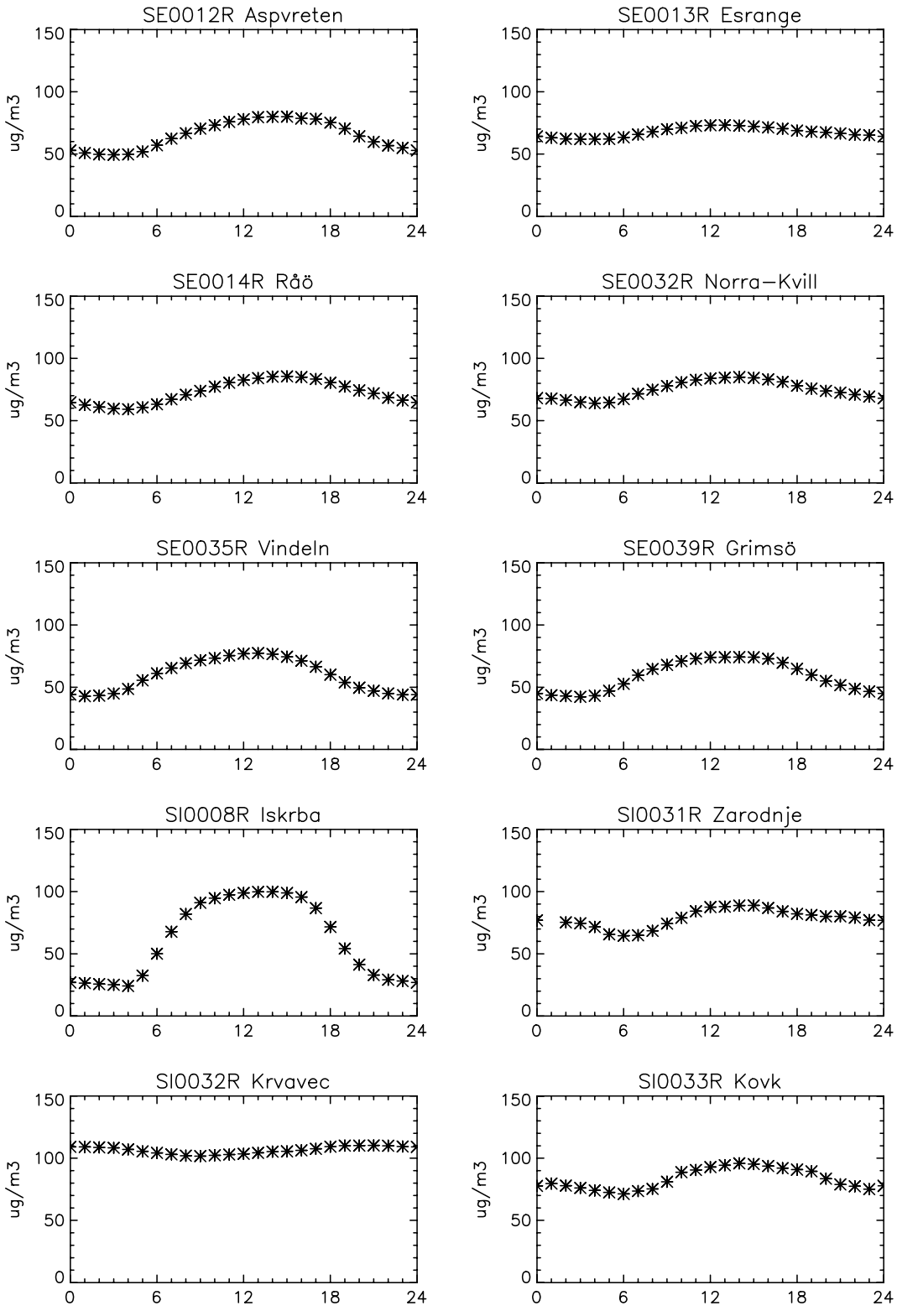

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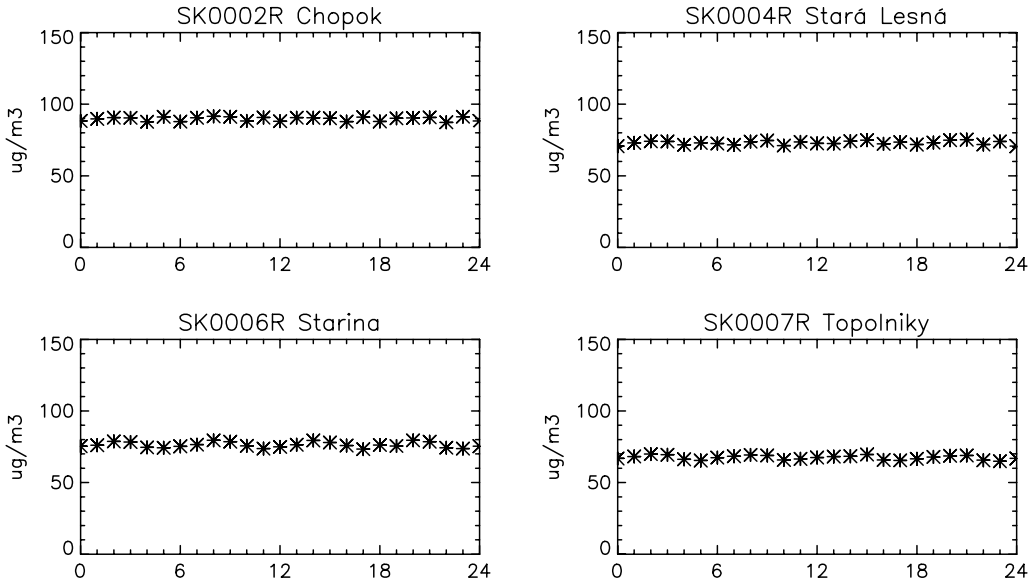

Figure 4.1, cont.

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.
Potsdam/Lillestrøm, Meteorological Service of the GDR/Norwegian Institute for Air Research, 1989.

Ozone measurements January 1986–December 1986. Report no. 2.
EMEP/CCC-Report 8/90 by U. Feister, U. Pedersen, E. Schulz and S. Hechler.
Lillestrøm, Norwegian Institute for Air Research, 1990.

Ozone data report 1988.
EMEP/CCC-Report 1/92 by U. Pedersen.
Lillestrøm, Norwegian Institute for Air Research, 1992.

Ozone data report 1989.
EMEP/CCC-Report 2/93 by U. Pedersen and I.M. Kvalvågnes.
Lillestrøm, Norwegian Institute for Air Research, 1993.

Ozone measurements 1990–1992.
EMEP/CCC-Report 4/95 by A.-G. Hjellbrekke.
Kjeller, Norwegian Institute for Air Research, 1995.

Ozone measurements 1993–1994.
EMEP/CCC-Report 1/96 by A.-G. Hjellbrekke.
Kjeller, Norwegian Institute for Air Research, 1996.

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Kjeller, Norwegian Institute for Air Research, 2002.

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Kjeller, Norwegian Institute for Air Research, 2003.

Ozone measurements 2002.
EMEP/CCC-Report 2/2004 by A.-G. Hjellbrekke and S. Solberg.
Kjeller, Norwegian Institute for Air Research, 2004.

Ozone measurements 2003.
EMEP/CCC-Report 4/2005 by A.-G. Hjellbrekke and S. Solberg.
Kjeller, Norwegian Institute for Air Research, 2005.

Ozone measurements 2004.
EMEP/CCC-Report 2/2006 by A.M. Fjæraa.
Kjeller, Norwegian Institute for Air Research, 2006.