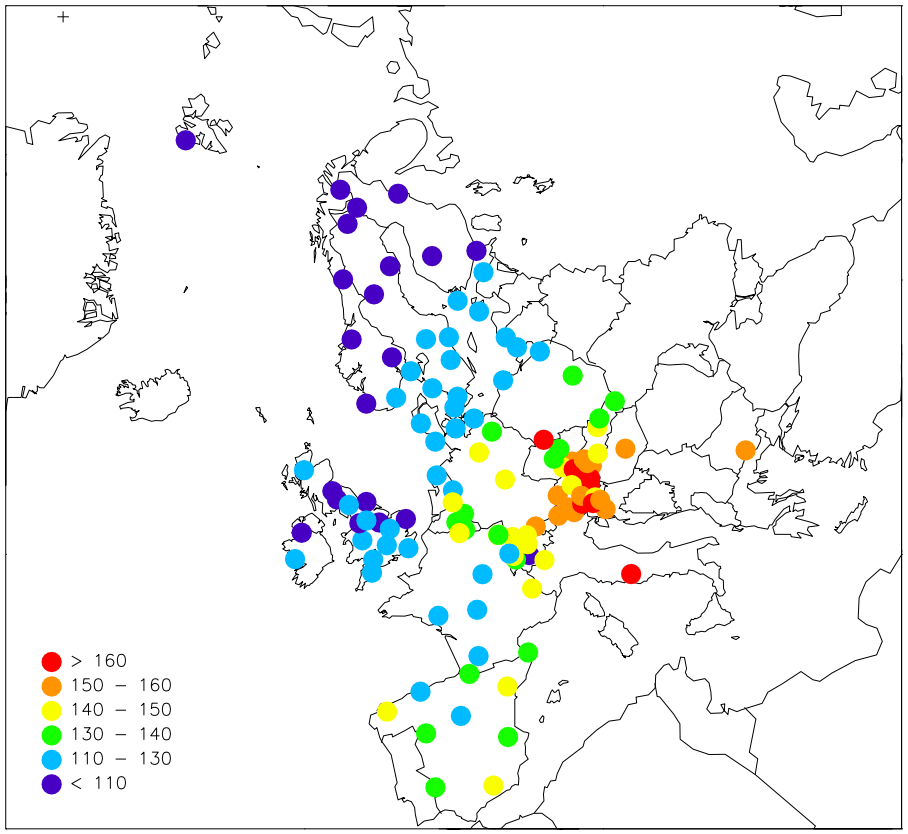
EMEP/CCC-Report 2/2009

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

Ozone measurements 2007

Ann Mari Fjæraa and Anne-Gunn Hjellbrekke



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1. Introduction

Ozone is a natural constituent of the atmosphere and plays a vital role in many atmospheric processes. However, man made emissions of volatile organic compounds and nitrogen oxides have increased the photochemical formation of ozone in the troposphere. Until the end of the 1960s the problem was basically believed to be one of the big cities and their immediate surroundings. In the 1970s, however, it was found that the problem of photochemical oxidant formation is much more 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.

The EMEP ozone data from 2007 are presented in this report, which aims to give a short summary of the measurement data. A complete set of data, including raw data, annual statistics and monthly means, can be downloaded from the web at http://ebas.nilu.no and http://www.nilu.no/projects/ccc.

2. Critical levels

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

The critical levels defined by ECE for protection of vegetation are 150 µg/m^3 for hourly mean, 60 µg/m^3 for eight-hour mean and 50 µg/m^3 for seven-hour mean (9 a.m. -4 p.m.) averaged over the growing season (April-September). 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 2007 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 2007. In total 121 stations in 27 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 2007.

Code	Station	Country	Latitude	Longitude	Altitude (m)
AT0002R	Illmitz	Austria	47 46 00 N	16 46 00 E	117
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
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
AT0048R	Zoebelboden	Austria	47 50 19 N	14 26 29 E	899
AT0049R	Grebenzen bei St. Lamprecht	Austria	47 02 25 N	14 19 48 E	1648
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
CH0001G	Jungfraujoch	Switzerland	46 32 51 N	7 59 06 E	3578
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
DE0007R	Neuglobsow	Germany	53 10 00 N	13 02 00 E	62
DE0008R	Schmücke	Germany	50 39 00 N	10 46 00 E	937
DE0009R	Zingst	Germany	54 26 00 N	12 44 00 E	1
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

Table 1, cont.

Code	Station	Country	Latitude	Longitude	Altitude (m)
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
ES0016R	O Saviñao	Spain	43 13 52 N	7 41 59 W	506
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
FI0096G	Pallas/Särkijärvi	Finland	68 00 00 N	24 09 00 E	340
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	45 48 00 N	2 04 00 E	810
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
GB0043R	Narberth	United Kingdom	51 14 00 N	4 42 00 W	160
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	250
HU0002R	K-puszta	Hungary	46 58 00 N	19 35 00 E	125
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
NL0007R	Eibergen	The Netherlands	52 05 00 N	6 34 00 E	20
NL0009R	Kollumerwaard	The Netherlands	53 20 02 N	6 16 38 E	1
NL0010R	Vredepeel	The Netherlands	51 32 28 N	5 51 13 E	28
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

Table 1, cont.

Code	Station	Country	Latitude	Longitude	Altitude (m)
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
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

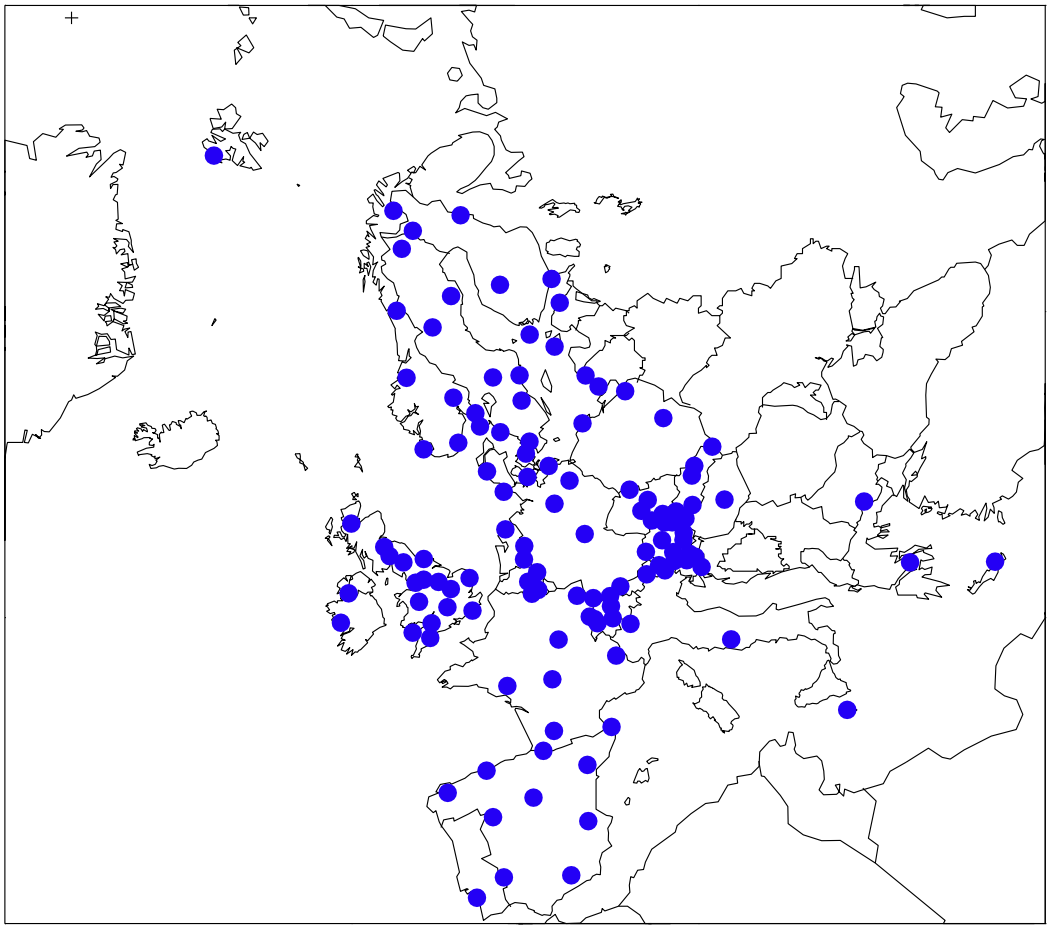

Figure 1: Location of the monitoring stations.

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.

As in earlier years, the ozone concentrations reported for the Greek station GR0001 Aliartos showed lower concentrations during the whole year compared to other EMEP sites. (1.10-169.1 ppt) Furthermore, monitoring of NO2 at the site revealed monthly mean concentrations of the order of 1.10 to 76.10 ug/m3. 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 this report. Data from GB0043 Narberth is removed from the report due to a data capture of only 9.8%.

The ozone sites are situated mainly in Central, Western and Northern Europe and the network of 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 was in 2000 collected from the participants (Aas et al., 2000).

The UV absorption method was the only measurement method in use in 2007.

All data presented in this report are given in $\mu g/m^3$. The conversion factor used to calculate from ppb to $\mu g/m^3$ 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 $\mu g/m^3$ by multiplying by 2.0 at the CCC.

Table 2: Conversion factor ppb – $\mu g/m^3$.

Country	Conversion factor
Austria	2.0
Belgium	unknown
Bulgaria	
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
Malta	
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 number of stations with data capture above 90% was in the same range as in earlier years, 104, compared to 103 stations in 2006 and 108 stations in 2005, and data capture was in general good. 5 sites had data capture below 75%.

Table 3: Data capture in per cent, 2007.

Code	Station	Data capture 2007
AT0002R	Illmitz	93.3
AT0005R	Vorhegg	92.4
AT0030R	Pillersdorf bei Retz	94.7
AT0032R	Sulzberg	93.4
AT0034G	Sonnblick	88.1
AT0037R	Zillertaler Alpen	96.1
AT0038R	Gerlitzen	93.8
AT0040R	Masenberg	88.2
AT0041R	Haunsberg	94.2
AT0042R	Heidenreichstein	95.4
AT0043R	Forsthof	91.4
AT0044R	Graz Platte	95.6
AT0045R	Dunkelsteinerwald	95.0
AT0046R	Gänserndorf	95.0
AT0047R	Stixneusiedl	95.5
AT0048R	Zoebelboden	92.5
AT0049R	Grebenzen bei St. Lamprecht	89.5
BE0001R	Offagne	92.2
BE0032R	Eupen	89.9
BE0035R	Vezin	93.2
BG0053R	Rojen peak	86.6
CH0001G	Jungfraujoch	96.9
CH0002R	Payerne	93.7
CH0003R	Tänikon	94.9
CH0004R	Chaumont	93.7
CH0005R	Rigi	94.6
CY0002R	Ayia Marina	93.3
CZ0001R	Svratouch	99.7
CZ0003R	Košetice	96.4
DE0001R	Westerland	94.3
DE0002R	Langenbrügge	94.6
DE0003R	Schauinsland	96.1
DE0007R	Neuglobsow	98.7
DE0008R	Schmücke	90.0
DE0009R	Zingst	95.3
DK0005R	Keldsnor	98.9
DK0031R	Ulborg	93.5
DK0041R	Lille Valby	96.5
EE0009R	Lahemaa	99.3
EE0011R	Vilsandi	98.0
ES0007R	Viznar	95.5
ES0008R	Niembro	99.0
ES0009R	Campisabalos	94.7
ES0010R	Cabo de Creus	97.1
ES0011R	Barcarrola	96.7
ES0012R	Zarra	97.0
ES0013R	Penausende	96.7
ES0014R	Els Torms	96.4
ES0016R	O Saviñao	97.1

Table 3, cont.

Code	Station	Data capture 2007
FI0009R	Utö	99.8
FI0017R	Virolahti II	98.8
FI0022R	Oulanka	99.1
FI0037R	Ahtari II	93.5
FI0096G	Pallas (Sammaltunturi)	96.2
FR0008R	Donon A	95.0
FR0008R	Donon B	96.4
FR0008R	Donon C	97.5
FR0008R	Donon D	95.0
FR0009R	Revin	96.5
FR0010R	Morvan	85.5
FR0012R	Iraty	92.2
FR0013R	Peyrusse Vieille	95.3
FR0014R	Montandon	95.0
FR0015R	La Tardière	94.0
FR0016R	Le Casset	95.8
FR0017R	Montfranc	96.4
GB0002R	Eskdalemuir	98.6
GB0006R	Lough Navar	97.9
GB0013R	Yarner Wood	95.2
GB0014R	High Muffles	98.5
GB0015R	Strath Vaich Dam	87.9
GB0031R	Aston Hill	91.9
GB0032R	Bottesford	99.5
GB0033R	Bush	98.7
GB0034R	Glazebury	72.9
GB0035R	Great Dun Fell	86.5
GB0036R	Harwell	82.4
GB0037R	Ladybower Res.	98.5
GB0038R	Lullington Heath	96.3
GB0039R	Sibton	95.4
GB0044R	Somerton	94.5
GB0045R	Wicken Fen	74.3
GR0002R	Finokalia	53.9
HU0002R	K-puszta	99.3
IE0031R	Mace Head	98.1
IT0001R	Montelibretti	99.0
IT0004R	Ispra	86.7
LT0015R	Preila	96.3
LV0010R	Rucava	89.2
MT0001R	Giordan lighthouse	55.4
NL0007R	Eibergen	96.9
NL0009R	Kollumerwaard	98.6
NL0010R	Vredepeel	97.2
NO0001R	Birkenes	99.6
NO0015R	Tustervatn	99.3
NO0039R	Kårvatn	99.2
NO0042G	Spitsbergen, Zeppelinfjell	94.5
NO0043R	Prestebakke	98.8
NO0052R	Sandve	88.3

Table 3, cont.

Code	Station	Data capture 2007
NO0055R	Karasjok	99.8
NO0056R	Hurdal	99.8
PL0002R	Jarczew	97.5
PL0003R	Sniezka	98.9
PL0004R	Leba	100.0
PL0005R	Diabla Gora	94.0
PT0004R	Monte Velho	42.5
SE0005R	Bredkälen	97.2
SE0011R	Vavihill	96.4
SE0012R	Aspvreten	91.9
SE0013R	Esrange	98.1
SE0014R	Råö	99.8
SE0032R	Norra-Kvill	95.1
SE0035R	Vindeln	98.8
SE0039R	Grimsö	99.2
SI0008R	Iskrba	95.4
SI0031R	Zarodnje	94.9
SI0032R	Krvavec	93.2
SI0033R	Kovk	82.9
SK0002R	Chopok	99.0
SK0004R	Stará Lesná	99.8
SK0006R	Starina	94.7
SK0007R	Topolniky	98.9

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 data capture of 85% 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

The heat wave in Europe in 2007 was two periods with extremely warm weather in mid summer in South- and Southeast Europe (Eastern Mediterranean and Balkan) around the dates 17-28 June and 15-26 July. The summer of 2007 must be seen as one of the warmest summers ever registered in Europe. The information threshold value (180 microgram/m3) was exceed at 24 sites in Central Europe (mainly Austria) during these warm periods. The highest one-hour ozone concentration of 235.0 µg/m^3 was observed in Illmitz at 17 July.

Ozone levels during the summer of 2007 were in general, however, among the lowest in the past decade. In contrast to the summer of 2006, no exceedances of

the information threshold value (180 µg/m^3) occurred in the northern part of Europe and Scandinavia.

The target value to protect human health (120 µg/m^3) was exceeded at almost all stations in Europe in 2007, including stations in Scandinavia. The occurrence of exceedances in summer 2007 was the second highest in the last decade in Europe, (EEA, 2008).

Table 1.1 in Annex 1 shows the extreme concentrations for 2007. The number of hours and days the ozone concentrations exceeded 120, 150, 180 and 200 µg/m^3 and the maxima are given. The highest hourly mean values were found at Illmitz, Austria (235.0 µg/m^3, 17 July) and at Montelibretti, Italy (233.9 µg/m^3, 18 July).

Values above 200 µg/m^3 were during 2007 measured at 10 sites in Central Europe, compared to 27 sites in 2007 and 12 sites in 2005. The lowest maximum value was observed at Zeppelin, Norway (100.7 µg/m^3, 13 April).

The one hour critical level for ozone formulated by the ECE for protection of vegetation, 150 µg/m^3, was in 2007 exceeded at 68 sites, this is around 50% of all stations, and much lower than in 2006 when 119 sites, i.e. at almost all measuring stations, had values above the 150 µg/m^3 limit. (Figure 1.3, Annex 1). At 3 sites the limit was exceeded 20 days or more, which is about the same number as in 2005 (4 days) but significantly lower than in 2006, when the limit was exceeded 20 days or more at 22 stations.

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 the public. At Montelibretti, the threshold value was exceeded 11 days, and 6 additional sites measured above 180 µg/m^3 for four days or more, four of these in Austria in July. In total values above 180 µg/m^3 were measured at 24 sites, located in Central Europe. The same numbers was for 2006 and 2005, 65 and 36 sites, respectively.

Table 1.2 in Annex 1 shows the 25-, 50-, 75-, 90-, 95-, 98- and 99-precentles for the period April-September for stations with data capture higher than 75%. Graphical distributions of the 99-percentiles and 95-percentiles are shown in Figure 1.1 and 1.2 in Annex 1. The lowest values are found in Scandinavia, United Kingdom and the Baltics where the 99-percentile is below 130 µg/m^3. The concentrations are higher in Central Europe, where the 99-percentile generally ranges from 130-160 µg/m^3. A few sites in Central Europe, including Ispra, had values above 160 µg/m^3.

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, a simple approach have been used for the calculations in this report, defining daylight hours as solar zenith angle less than 80°.

AOT40 and AOT60 for forest and agricultural corps for 2007 are shown in Table 2.1 and Table 2.2 in Annex 2, and the corresponding geographical distributions of AOT40 and AOT60 are shown in Figure 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, Ireland and in the UK, and in Northern Europe as a whole, while the highest values are found mainly in Austria. The critical level for forest in April-September (10 000 ppbh) is exceeded in most South-European countries. In total 4 stations in Austria and Poland had AOT40 (May-July) values above 15 000 ppbh. The critical level for agricultural crops, 3 000 ppbh, was in 2007 exceeded at most South-European stations, some stations in Germany and some stations in Southern Scandinavia. There were no exceedances of this level in Northern Scandinavia and in Ireland and the UK.

7. Seasonal variation

Monthly mean concentrations for 2007 are given in Table 3.1 and monthly data capture in Table 3.2 in Annex 3. The concentrations show a clear pattern with maximum values during spring or early summer and minimum in winter. The seasonal variation 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 1990-2007 are given in Figure 3.1 in 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 spring 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) 2007 is shown in Annex 4. In general the lowest concentrations are found in early morning and the highest in the afternoon.

The most pronounced diurnal variation is found at the rural sites in Central Europe e.g. sites in Austria, Switzerland, most of the German sites and Ispra in Italy. Typical for those sites is a more marked peak in the diurnal cycle with a characteristic maximum around mid-afternoon. The pronounced diurnal peak during the summer months is due to photochemical generation of ozone during

daytime as a result of higher temperature and insolation during this time of the day. However, during the night, more stable atmospheric conditions and nocturnal inversions prevent the vertical mixing and the transport of ozone from the free troposphere into the boundary layer. A weaker diurnal variation is observed at the coastal and island stations and at the remote sites in Norway and Sweden. Mace Head, situated on the west coast of Ireland, has roughly the same average concentrations as the rural sites in Central Europe but almost no diurnal variation due to remoteness from source areas and prevailing westerly winds. Zeppelinfjellet at Spitsbergen shows no diurnal variation. Elevated sites like 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 30.June, 2009.

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 2007.

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	8176	361	376	63	48	10	17	4	10	3	235.0	17.07.2007
AT0005R	Vorhegg	8093	359	411	59	69	15	2	1	0	0	195.0	20.07.2007
AT0030R	Pillersdorf bei Retz	8293	365	402	67	76	17	6	3	0	0	194.0	17.07.2007
AT0032R	Sulzberg	8180	361	569	70	51	12	0	0	0	0	170.0	06.08.2007
AT0034G	Sonnblick	7718	344	1319	130	77	15	0	0	0	0	170.0	25.05.2007
AT0037R	Zillertaler Alpen	8421	365	702	90	48	9	0	0	0	0	180.0	17.07.2007
AT0038R	Gerlitzen	8215	365	1048	97	80	12	2	2	0	0	185.0	17.07.2007
AT0040R	Masenberg	7724	342	775	69	83	9	9	3	0	0	197.0	18.07.2007
AT0041R	Haunsberg	8252	365	480	65	72	12	8	1	0	0	196.0	17.07.2007
AT0042R	Heidenreichstein	8354	365	386	64	31	8	2	1	0	0	190.0	17.07.2007
AT0043R	Forsthof	8003	357	480	64	57	7	26	4	0	0	197.0	18.07.2007
AT0044R	Graz Platte	8374	365	797	92	101	12	12	4	1	1	205.0	20.07.2007
AT0045R	Dunkelsteinerwald	8319	365	296	50	65	13	25	6	5	2	215.0	20.07.2007
AT0046R	Gänserndorf	8319	365	405	71	48	15	7	2	0	0	196.0	17.07.2007
AT0047R	Stixneusiedl	8364	365	421	67	60	11	17	3	7	3	215.0	17.07.2007
AT0048R	Zoebelboden	8098	359	355	49	34	7	0	0	0	0	170.0	20.07.2007
AT0049R	Grebenzen bei St. Lamprecht	7841	347	562	61	47	7	0	0	0	0	171.0	19.07.2007
BE0001R	Offagne	8076	353	138	27	5	3	0	0	0	0	162.0	29.04.2007
BE0032R	Eupen	7873	348	110	23	19	4	0	0	0	0	179.0	27.04.2007
BE0035R	Vezin	8164	357	100	21	13	6	0	0	0	0	175.0	28.04.2007
BG0053R	Rojen peak	7590	326	343	46	60	13	8	5	1	1	203.5	25.07.2007
CH0001G	Jungfraujoch	8485	365	6	3	0	0	0	0	0	0	143.4	09.08.2007
CH0002R	Payerne	8210	361	233	54	9	3	0	0	0	0	175.6	16.07.2007
CH0003R	Tänikon	8316	365	287	61	31	13	0	0	0	0	166.3	29.04.2007
CH0004R	Chaumont	8209	360	649	71	23	7	0	0	0	0	165.8	25.04.2007
CH0005R	Rigi	8290	365	596	77	27	12	0	0	0	0	177.4	16.07.2007
CY0002R	Ayia Marina	8174	355	1333	143	9	3	0	0	0	0	154.0	25.07.2007
CZ0001R	Svratouch	8736	365	180	30	8	2	0	0	0	0	174.4	17.07.2007
CZ0003R	Košetice	8446	363	330	51	13	4	7	1	3	1	205.7	17.07.2007
DE0001R	Westerland	8260	363	72	21	5	1	0	0	0	0	163.9	05.08.2007
DE0002R	Langenbrügge	8287	365	200	36	10	3	0	0	0	0	167.4	08.06.2007
DE0003R	Schauinsland	8413	365	641	68	41	9	1	1	0	0	180.3	16.07.2007

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)
DE0007R	Neuglobsow	8644	365	159	34	8	3	0	0	0	0	159.2	12.06.2007
DE0008R	Schmücke	7883	346	472	45	26	6	0	0	0	0	175.2	16.07.2007
DE0009R	Zingst	8346	365	28	6	0	0	0	0	0	0	136.1	26.04.2007
DK0005R	Keldsnor	8661	364	26	9	0	0	0	0	0	0	141.5	05.08.2007
DK0031R	Ulborg	8189	360	49	13	1	1	0	0	0	0	150.0	05.08.2007
DK0041R	Lille Valby	8455	357	71	16	0	0	0	0	0	0	148.9	10.06.2007
EE0009R	Lahemaa	8695	365	34	9	0	0	0	0	0	0	149.0	29.05.2007
EE0011R	Vilsandi	8583	363	15	6	0	0	0	0	0	0	143.0	25.05.2007
ES0007R	Vφznar	8363	363	614	111	13	6	0	0	0	0	169.2	22.06.2007
ES0008R	Niembro	8670	365	86	19	0	0	0	0	0	0	142.1	11.08.2007
ES0009R	Campisabalos	8299	365	67	26	2	2	0	0	0	0	158.3	31.07.2007
ES0010R	Cabo de Creus	8503	364	204	46	1	1	0	0	0	0	150.7	27.07.2007
ES0011R	Barcarrola	8468	364	122	20	8	1	0	0	0	0	166.1	04.09.2007
ES0012R	Zarra	8498	364	172	39	0	0	0	0	0	0	149.7	28.08.2007
ES0013R	Penausende	8472	365	248	50	4	1	0	0	0	0	156.7	11.08.2007
ES0014R	Els Torms	8443	364	488	76	41	10	1	1	0	0	182.3	12.05.2007
ES0016R	O Saviñao	8501	365	248	34	22	9	0	0	0	0	167.3	13.09.2007
FI0009R	Utö	8740	365	2	2	0	0	0	0	0	0	122.0	26.05.2007, 27.07.2007
FI0017R	Virolahti II	8653	365	4	1	0	0	0	0	0	0	127.0	13.08.2007
FI0022R	Oulanka	8681	365	27	3	0	0	0	0	0	0	129.0	27.03.2007
FI0037R	Ahtari II	8192	348	13	2	0	0	0	0	0	0	131.0	29.03.2007
FI0096G	Pallas (Sammaltunturi)	8424	359	62	6	0	0	0	0	0	0	134.0	28.03.2007
FR0008R	Donon A	8319	360	389	53	13	5	0	0	0	0	173.0	16.07.2007
FR0008R	Donon B	8444	360	448	58	16	6	0	0	0	0	176.0	16.07.2007
FR0008R	Donon C	8544	364	475	64	21	7	0	0	0	0	175.0	16.07.2007
FR0008R	Donon D	8321	360	326	47	10	5	0	0	0	0	172.0	16.07.2007
FR0009R	Revin	8456	362	177	25	20	5	0	0	0	0	167.0	28.04.2007
FR0010R	Morvan	7489	321	22	7	0	0	0	0	0	0	140.0	04.05.2007
FR0012R	Iraty	8074	347	429	56	1	1	0	0	0	0	152.0	16.04.2007
FR0013R	Peyrusse Vieille	8351	360	11	3	0	0	0	0	0	0	137.0	14.08.2007
FR0014R	Montandon	8318	352	61	17	0	0	0	0	0	0	150.0	05.12.2007
FR0015R	La Tardière	8232	349	34	14	0	0	0	0	0	0	130.0	05.08.2007

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)
FR0016R	Le Casset	8389	363	824	83	16	4	0	0	0	0	166.0	16.07.2007
FR0017R	Montfranc	8442	360	157	20	7	2	0	0	0	0	173.0	17.04.2007
GB0002R	Eskdalemuir	8640	364	7	2	0	0	0	0	0	0	130.0	14.04.2007
GB0006R	Lough Navar	8573	364	0	0	0	0	0	0	0	0	116.0	11.06.2007
GB0013R	Yarner Wood	8340	363	31	7	0	0	0	0	0	0	142.0	09.06.2007
GB0014R	High Muffles	8628	365	15	3	0	0	0	0	0	0	146.0	03.06.2007
GB0015R	Strath Vaich Dam	7699	333	25	8	0	0	0	0	0	0	134.0	05.05.2007
GB0031R	Aston Hill	8048	341	20	6	0	0	0	0	0	0	138.0	21.04.2007
GB0032R	Bottesford	8717	365	25	6	0	0	0	0	0	0	140.0	05.08.2007
GB0033R	Bush	8644	365	0	0	0	0	0	0	0	0	114.0	30.03.2007
GB0034R	Glazebury	6382	270	15	5	0	0	0	0	0	0	136.0	10.06.2007
GB0035R	Great Dun Fell	7578	324	29	7	0	0	0	0	0	0	148.0	11.06.2007
GB0036R	Harwell	7218	308	21	6	0	0	0	0	0	0	148.0	09.06.2007
GB0037R	Ladybower Res.	8626	365	20	4	0	0	0	0	0	0	148.0	15.04.2007
GB0038R	Lullington Heath	8436	358	38	8	0	0	0	0	0	0	138.0	24.04.2007, 24.05.2007
GB0039R	Sibton	8359	353	7	1	2	1	0	0	0	0	152.0	05.08.2007
GB0044R	Somerton	8278	352	17	5	0	0	0	0	0	0	136.0	09.06.2007
GB0045R	Wicken Fen	6505	277	41	9	0	0	0	0	0	0	142.0	05.08.2007
GR0002R	Finokalia	4723	210	1852	111	109	18	4	1	0	0	185.0	26.07.2007
HU0002R	K-puszta	8700	365	700	104	62	17	3	1	1	1	210.0	19.07.2007
IE0031R	Mace Head	8595	361	52	10	0	0	0	0	0	0	148.0	05.05.2007
IT0001R	Montelibretti	8671	364	570	118	107	36	23	11	5	4	233.9	18.07.2007
IT0004R	Ispra	7597	328	139	40	8	4	0	0	0	0	164.2	14.07.2007
LT0015R	Preila	8438	359	26	8	0	0	0	0	0	0	132.0	01.04.2007
LV0010R	Rucava	7815	334	16	4	0	0	0	0	0	0	141.0	22.05.2007
MT0001R	Giordan lighthouse	4850	206	57	20	0	0	0	0	0	0	140.0	09.04.2007
NL0007R	Eibergen	8490	362	46	12	0	0	0	0	0	0	147.8	25.04.2007
NL0009R	Kollumerwaard	8636	365	83	23	9	4	0	0	0	0	166.6	06.08.2007
NL0010R	Vredepeel	8518	363	133	25	37	11	0	0	0	0	179.9	28.04.2007
NO0001R	Birkenes	8726	365	33	11	0	0	0	0	0	0	138.8	30.03.2007
NO0015R	Tustervatn	8701	365	25	4	0	0	0	0	0	0	126.8	27.03.2007

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)
NO0039R	Kårvatn	8693	365	0	0	0	0	0	0	0	0	114.2	15.04.2007
NO0042G	Spitsbergen, Zeppelinfjell	8274	361	0	0	0	0	0	0	0	0	100.7	13.04.2007
NO0043R	Prestebakke	8650	363	32	7	0	0	0	0	0	0	132.0	08.06.2007
NO0052R	Sandve	7738	328	6	2	0	0	0	0	0	0	126.1	29.03.2007
NO0055R	Karasjok	8742	365	56	5	0	0	0	0	0	0	138.6	28.03.2007
NO0056R	Hurdal	8739	365	6	3	0	0	0	0	0	0	124.3	30.03.2007
PL0002R	Jarczew	8539	362	194	46	6	3	0	0	0	0	162.0	27.07.2007
PL0003R	Sniezka	8662	363	1345	106	195	36	9	3	0	0	194.0	17.07.2007
PL0004R	Leba	8756	365	56	12	0	0	0	0	0	0	143.0	12.06.2007
PL0005R	Diabla Gora	8232	347	121	27	10	3	0	0	0	0	160.0	31.03.2007
PT0004R	Monte Velho	3722	156	4	2	0	0	0	0	0	0	129.0	09.05.2007
SE0005R	Bredkälen	8517	357	0	0	0	0	0	0	0	0	119.0	05.06.2007
SE0011R	Vavihill	8445	354	89	18	0	0	0	0	0	0	143.0	02.04.2007
SE0012R	Aspvreten	8047	347	69	16	0	0	0	0	0	0	144.0	28.03.2007, 06.06.2007
SE0013R	Esrange	8594	360	65	5	0	0	0	0	0	0	129.0	27.03.2007, 28.03.2007, 29.03.2007
SE0014R	Råø	8740	365	37	10	0	0	0	0	0	0	140.0	09.06.2007
SE0032R	Norra-Kvill	8331	353	77	11	0	0	0	0	0	0	135.0	12.06.2007
SE0035R	Vindeln	8655	365	1	1	0	0	0	0	0	0	122.0	05.06.2007
SE0039R	Grimsø	8692	365	32	7	0	0	0	0	0	0	142.0	16.04.2007
SI0008R	Iskrba	8361	365	505	76	44	12	7	2	0	0	194.0	18.07.2007
SI0031R	Zarodnje	8308	365	461	62	36	5	2	1	0	0	182.0	20.07.2007
SI0032R	Krvavec	8167	363	1392	131	118	22	18	4	2	1	208.0	21.07.2007
SI0033R	Kovk	7262	325	439	52	86	13	2	2	0	0	187.0	21.07.2007
SK0002R	Chopok	8672	365	753	82	38	8	0	0	0	0	168.0	19.07.2007
SK0004R	Stará Lesná	8739	365	294	47	17	3	0	0	0	0	164.0	28.04.2007
SK0006R	Starina	8292	365	222	50	14	5	0	0	0	0	161.0	27.04.2007
SK0007R	Topolniky	8663	365	406	71	36	7	4	1	1	1	203.0	17.07.2007

Table 1.2: Percentiles of hourly ozone values April–September 2007.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
AT0002R	Illmitz	56.0	75.0	98.0	119.0	130.0	142.0	157.2	91.9
AT0005R	Vorhegg	61.0	80.5	102.0	121.0	133.0	149.0	158.0	92.7
AT0030R	Pillersdorf bei Retz	62.0	80.0	99.0	119.0	133.0	149.0	159.5	94.4
AT0032R	Sulzberg	74.0	92.0	110.0	124.0	134.0	146.0	153.0	94.4
AT0034G	Sonnblick	98.0	112.0	123.0	132.0	140.0	149.5	155.0	92.8
AT0037R	Zillertaler Alpen	83.0	99.5	114.0	125.0	132.0	143.0	151.0	96.2
AT0038R	Gerlitzen	94.0	108.0	120.0	130.0	137.0	150.0	161.2	95.1
AT0040R	Masenberg	80.0	97.0	115.0	129.0	137.0	151.0	162.0	93.2
AT0041R	Haunsberg	69.0	86.0	105.0	123.0	134.0	148.0	158.1	93.0
AT0042R	Heidenreichstein	56.0	78.0	98.0	118.0	129.0	138.0	146.0	95.2
AT0043R	Forsthof	72.0	89.0	107.0	123.0	132.0	146.0	169.0	89.4
AT0044R	Graz Platte	74.0	96.0	115.0	130.0	139.0	153.0	165.0	95.6
AT0045R	Dunkelsteinerwald	46.0	66.0	90.0	113.0	127.0	146.0	162.0	95.2
AT0046R	Gänserndorf	52.0	72.0	96.0	120.0	131.6	144.0	152.0	94.4
AT0047R	Stixneusiedl	58.0	76.0	99.0	120.0	131.0	145.0	157.0	95.4
AT0048R	Zoebelboden	72.0	88.0	104.0	118.0	127.0	139.0	148.0	91.1
AT0049R	Grebenzen bei St. Lamprecht	84.0	99.0	114.0	124.0	130.5	145.0	152.0	83.5
BE0001R	Offagne	44.0	60.0	80.0	101.0	114.0	127.0	133.0	95.5
BE0032R	Eupen	41.0	57.0	74.0	94.0	108.0	128.0	138.8	90.2
BE0035R	Vezin	29.0	48.0	68.0	88.0	106.0	124.0	137.0	93.5
BG0053R	Rojen peak	65.3	86.0	100.2	118.1	133.3	147.8	159.6	85.7
CH0001G	Jungfraujoch	71.9	81.3	89.9	97.8	101.6	105.8	107.7	96.5
CH0002R	Payerne	46.3	65.2	87.6	110.5	121.4	132.4	139.1	94.1
CH0003R	Tänikon	46.8	65.2	88.7	111.8	124.6	138.6	148.6	95.2
CH0004R	Chaumont	73.6	91.4	110.9	126.1	133.0	138.8	144.7	92.2
CH0005R	Rigi	73.8	89.8	109.0	124.2	134.0	142.7	148.2	95.2
CY0002R	Ayia Marina	100.3	112.3	121.9	129.5	134.1	138.4	142.0	90.8
CZ0001R	Svratouch	53.7	72.2	91.4	109.1	118.0	127.7	132.1	100.0
CZ0003R	Košetice	57.9	76.4	96.4	115.1	124.9	132.7	138.1	94.1
DE0001R	Westerland	65.4	75.4	88.9	99.0	105.6	117.7	124.4	95.1
DE0002R	Langenbrügge	44.9	60.5	80.1	104.7	119.2	134.1	141.1	95.4
DE0003R	Schauinsland	74.0	91.8	111.6	125.0	132.4	141.0	149.6	96.1
DE0007R	Neuglobsow	40.7	60.0	80.3	99.0	113.8	125.9	133.0	99.5
DE0008R	Schmücke	59.0	77.8	101.6	122.5	134.0	143.1	147.2	86.5
DE0009R	Zingst	50.5	62.9	77.6	89.1	96.5	106.0	115.4	95.3
DK0005R	Keldsnor	52.9	65.3	80.7	90.9	98.3	108.3	115.3	98.8
DK0031R	Ulborg	58.0	68.9	82.2	93.3	100.6	113.6	119.9	94.0
DK0041R	Lille Valby	51.4	67.1	82.4	95.8	105.2	113.6	124.3	93.6
EE0009R	Lahemaa	44.0	61.0	78.0	91.0	99.0	108.0	114.0	99.3
EE0011R	Vilsandi	61.0	72.0	83.0	94.0	103.7	111.0	115.5	99.0
ES0007R	Viznar	85.0	99.4	112.3	123.0	129.1	136.6	141.5	95.9
ES0008R	Niembro	59.9	73.5	89.3	103.2	112.2	120.0	124.7	99.1
ES0009R	Campisabalos	61.4	78.6	92.4	104.5	111.9	118.6	122.9	95.8
ES0010R	Cabo de Creus	73.0	85.8	99.5	110.9	118.3	128.6	133.8	98.8
ES0011R	Barcarrola	52.2	71.9	91.2	105.7	113.6	124.1	130.9	96.2
ES0012R	Zarra	74.6	86.6	98.9	110.6	117.7	126.4	132.3	96.7
ES0013R	Penausende	67.5	83.9	100.7	113.8	121.7	130.1	135.3	96.6
ES0014R	Els Torms	74.1	90.5	107.6	121.8	132.2	141.3	148.9	95.8
ES0016R	O Saviñao	54.7	70.1	87.9	108.5	122.7	134.4	140.6	96.7
FI0009R	Utö	61.0	71.0	82.0	91.0	98.0	106.0	112.0	99.7
FI0017R	Virolahti II	41.0	59.0	74.0	86.0	93.0	102.0	107.0	98.9
FI0022R	Oulanka	40.0	52.0	71.0	83.0	88.0	93.0	97.0	99.6
FI0037R	Ahtari II	45.8	63.0	77.0	88.0	94.0	102.0	108.0	92.8
FI0096G	Pallas (Sammaltunturi)	53.0	64.0	80.0	88.0	94.0	98.0	102.8	94.7
FR0008R	Donon A	64.0	81.0	104.0	119.0	128.0	137.0	142.0	97.8
FR0008R	Donon B	66.0	82.0	105.0	121.0	129.0	138.0	143.0	99.2
FR0008R	Donon C	66.0	84.0	106.0	122.0	130.0	139.0	144.0	99.3
FR0008R	Donon D	62.0	78.0	101.0	117.0	126.0	134.0	140.0	97.8
FR0009R	Revin	47.0	60.0	80.3	103.0	118.0	133.0	142.7	96.4
FR0010R	Morvan	46.0	61.0	77.0	93.0	102.0	113.0	117.0	89.1
FR0012R	Iraty	74.0	90.0	105.0	120.0	125.0	132.0	137.0	97.2
FR0013R	Peyrusse Vieille	47.0	63.0	79.0	93.0	101.0	110.0	115.0	95.7
FR0014R	Montandon	42.0	56.0	71.0	87.0	99.0	112.0	117.0	94.0
FR0015R	La Tardière	47.0	62.0	77.0	93.0	103.0	114.0	119.0	97.7
FR0016R	Le Casset	89.0	100.0	115.0	128.0	134.0	140.0	144.0	96.8
FR0017R	Montfranc	60.0	72.0	91.0	109.0	117.7	124.0	128.0	96.7

Table 1.2, cont.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
GB0002R	Eskdalemuir	44.0	54.0	68.0	81.0	88.0	96.0	102.0	98.9
GB0006R	Lough Navar	32.0	44.0	56.0	70.0	80.0	92.0	98.0	97.9
GB0013R	Yarner Wood	48.0	60.0	74.0	88.0	100.0	112.0	120.0	93.6
GB0014R	High Muffles	44.0	56.0	72.0	84.0	92.0	103.4	110.0	98.2
GB0015R	Strath Vaich Dam	54.0	62.0	78.0	90.0	98.0	106.0	116.0	88.7
GB0031R	Aston Hill	50.0	60.0	74.0	88.0	96.0	106.0	116.0	98.0
GB0032R	Bottesford	32.0	48.0	64.0	80.0	88.0	100.0	110.0	99.6
GB0033R	Bush	46.0	56.0	68.0	80.0	84.0	90.0	94.0	99.2
GB0034R	Glazebury	30.0	48.0	62.0	76.0	86.0	98.0	108.0	95.2
GB0035R	Great Dun Fell	52.0	66.0	76.0	88.0	98.0	108.0	114.2	77.1
GB0036R	Harwell	40.0	52.0	66.0	80.0	88.0	100.0	116.0	84.3
GB0037R	Ladybower Res.	46.0	56.0	70.0	84.0	92.0	104.0	114.0	98.9
GB0038R	Lullington Heath	46.0	60.0	74.0	86.0	96.0	110.0	116.7	94.9
GB0039R	Sibton	40.0	54.0	70.0	82.0	90.0	98.0	104.0	91.8
GB0044R	Somerton	44.0	58.0	70.0	86.0	96.0	105.2	113.6	91.5
GB0045R	Wicken Fen	36.0	54.0	72.0	88.0	98.0	108.0	120.0	97.9
HU0002R	K-puszta	54.0	81.0	110.0	130.0	139.0	147.0	154.0	99.3
IE0031R	Mace Head	60.0	68.0	82.0	94.0	102.0	114.0	124.0	97.6
IT0001R	Montelibretti	29.5	62.8	101.8	125.7	138.8	153.4	168.3	98.8
IT0004R	Ispra	15.6	39.1	67.3	96.7	116.6	132.2	141.1	78.3
LT0015R	Preila	56.0	68.0	80.5	92.0	101.0	111.0	116.0	97.7
LV0010R	Rucava	45.0	59.0	71.0	82.0	90.0	101.0	111.0	84.8
NL0007R	Eibergen	26.6	41.0	60.0	81.2	96.8	112.9	121.9	97.5
NL0009R	Kollumerwaard	48.0	63.8	81.6	97.0	106.6	119.5	128.0	98.0
NL0010R	Vredepeel	25.6	42.5	62.7	88.0	107.8	130.5	148.1	96.2
NO0001R	Birkenes	44.0	58.9	74.0	91.0	99.2	108.0	116.0	99.8
NO0015R	Tustervatn	51.2	62.3	77.7	89.5	94.0	97.6	100.6	99.6
NO0039R	Kårvatn	31.8	52.2	71.4	85.0	90.6	96.3	100.7	99.5
NO0042G	Spitsbergen, Zeppelinfjell	51.1	59.5	70.6	83.8	87.6	90.8	92.7	95.0
NO0043R	Prestebakke	49.8	62.4	76.4	89.2	97.0	105.5	113.8	99.8
NO0052R	Sandve	56.0	64.4	73.6	83.0	89.2	100.5	107.3	84.7
NO0055R	Karasjok	45.0	57.2	74.0	85.2	90.4	95.6	99.2	99.9
NO0056R	Hurdal	38.8	54.4	70.0	83.7	91.0	100.7	105.0	99.8
PL0002R	Jarczew	38.0	60.0	84.0	106.0	117.0	127.0	133.0	99.1
PL0003R	Sniezka	89.0	104.0	123.0	140.0	149.0	158.0	163.1	100.0
PL0004R	Leba	65.0	76.0	88.0	99.0	108.0	116.0	121.0	100.0
PL0005R	Diabla Gora	48.0	64.0	80.5	96.0	107.0	120.0	126.0	94.3
SE0005R	Bredkälen	52.0	63.0	78.0	88.0	92.0	97.0	101.0	94.7
SE0011R	Vavihill	52.0	66.0	80.0	95.0	106.0	118.0	125.0	93.1
SE0012R	Aspvreten	47.0	66.0	86.0	100.0	107.0	116.0	122.0	92.1
SE0013R	Esrange	51.0	62.0	79.0	89.0	94.0	99.0	103.0	99.8
SE0014R	Råö	58.0	69.0	82.0	92.0	100.0	110.0	119.0	99.8
SE0032R	Norra-Kvill	47.0	65.0	83.0	98.0	106.0	114.0	119.1	95.4
SE0035R	Vindeln	39.0	56.0	74.0	85.0	90.0	94.0	97.0	99.3
SE0039R	Grimsö	45.0	61.0	77.0	90.0	96.0	105.0	111.0	99.7
SI0008R	Iskbra	17.0	64.0	102.0	122.0	131.0	142.0	151.0	95.5
SI0031R	Zarodnje	69.0	88.0	107.0	121.0	130.0	142.1	148.0	95.5
SI0032R	Krvavec	96.0	112.0	125.0	137.0	145.0	156.0	166.0	92.7
SI0033R	Kovk	63.0	86.5	108.0	125.0	139.0	153.0	160.0	78.2
SK0002R	Chopok	90.0	101.0	114.0	127.0	134.0	144.0	150.0	98.2
SK0004R	Stará Lesná	58.0	79.0	99.0	114.0	124.0	134.0	139.0	99.8
SK0006R	Starina	53.0	73.0	94.0	110.9	121.0	132.0	140.0	92.2
SK0007R	Topolniky	50.0	70.0	97.0	119.0	129.0	138.0	146.6	98.7

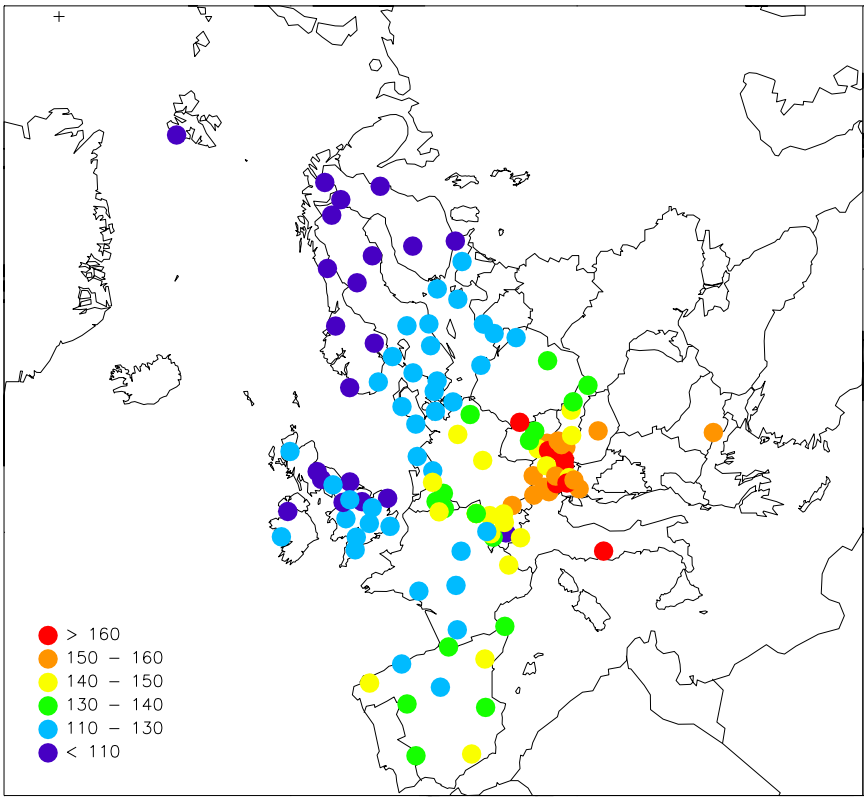


Figure 1.1: Ozone April–September 2007. 99-percentiles (μg/m^3).

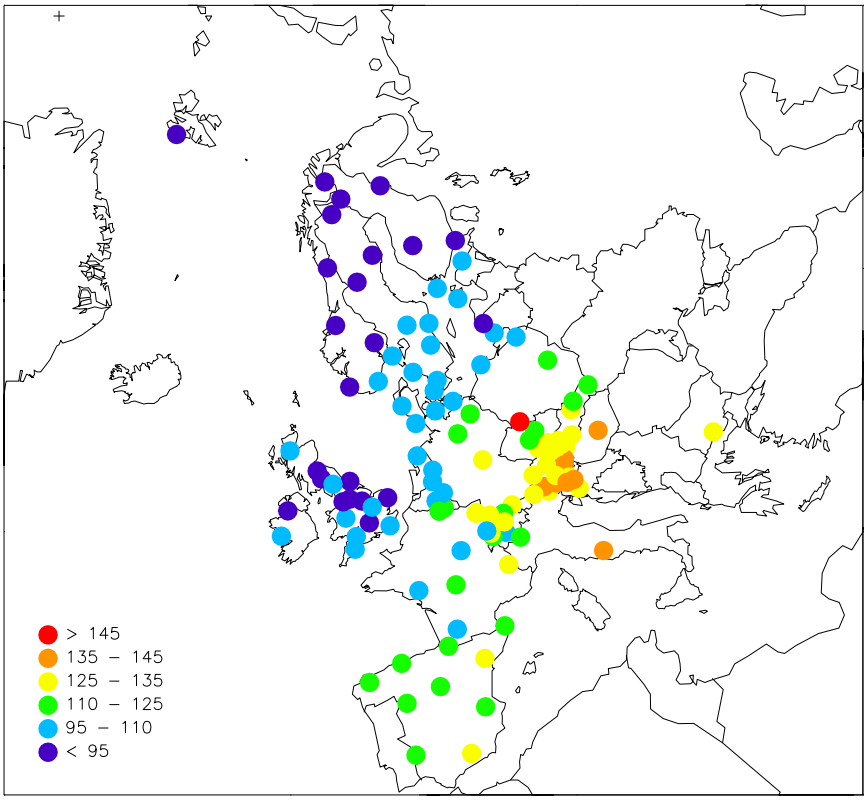


Figure 1.2: Ozone April–September 2007. 95-percentiles (μg/m^3).

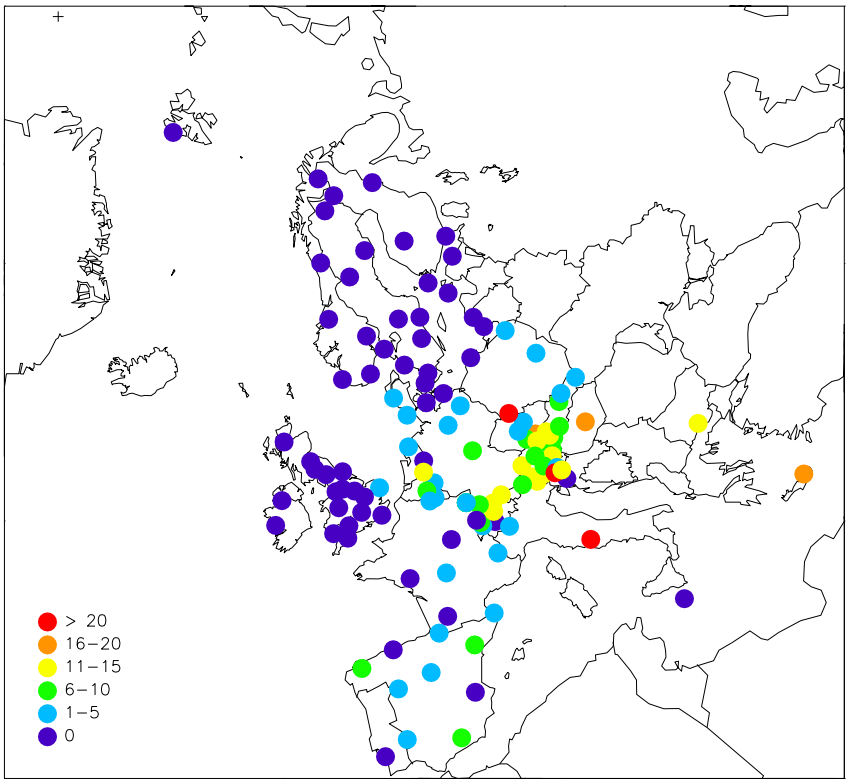


Figure 1.3: Number of exceedances of the threshold value of 150 µg/m^3. (Unit: number of days).

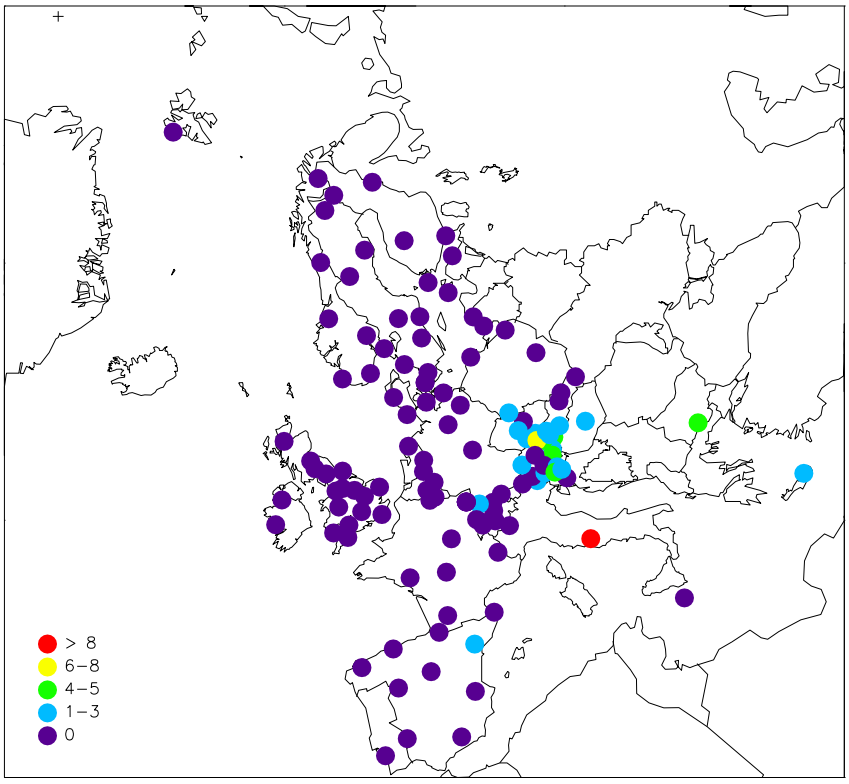


Figure 1.4: Number of exceedances of the threshold value of 180 µg/m^3. (Unit: number of days).

Annex 2

AOT40 and AOT60, figures and tables

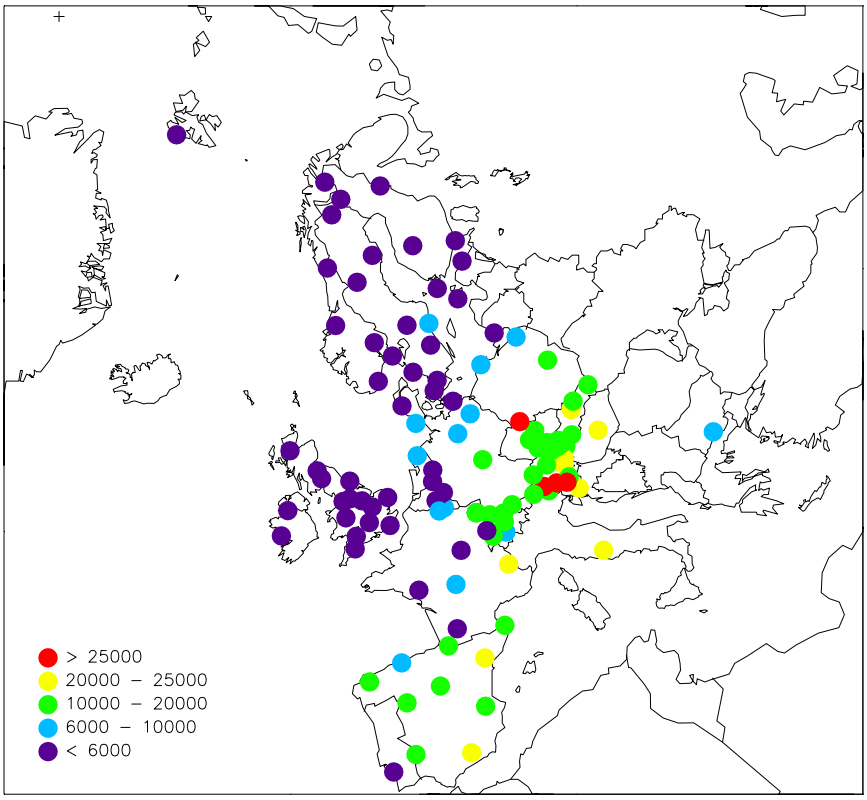


Figure 2.1: AOT40 (ppbh) April–September 2007 (daylight hours).

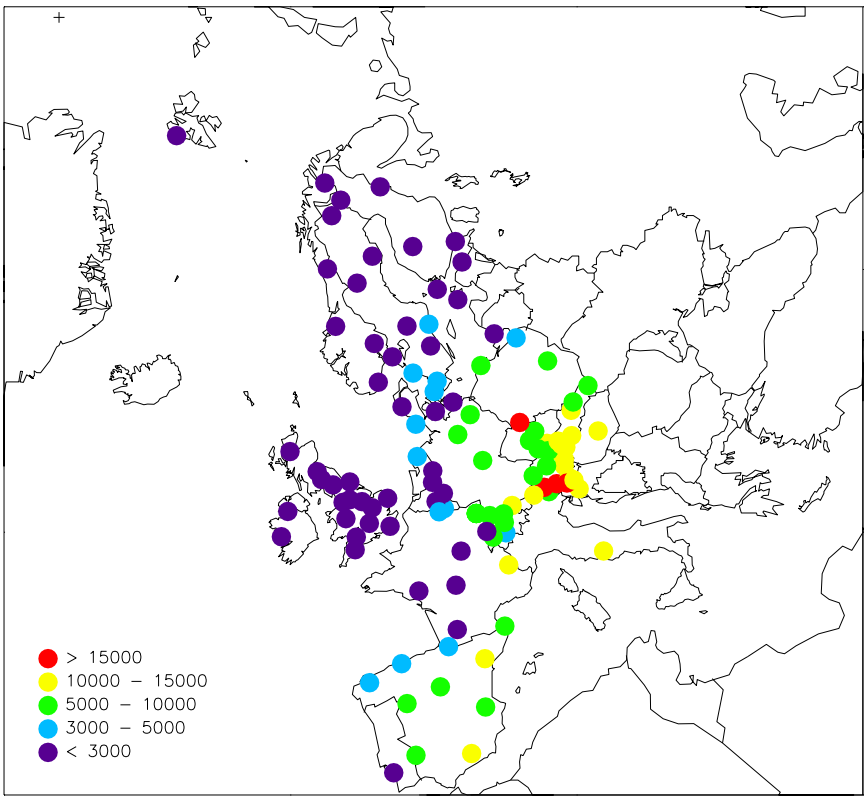


Figure 2.2: AOT40 (ppbh) May, June and July 2007 (daylight hours).

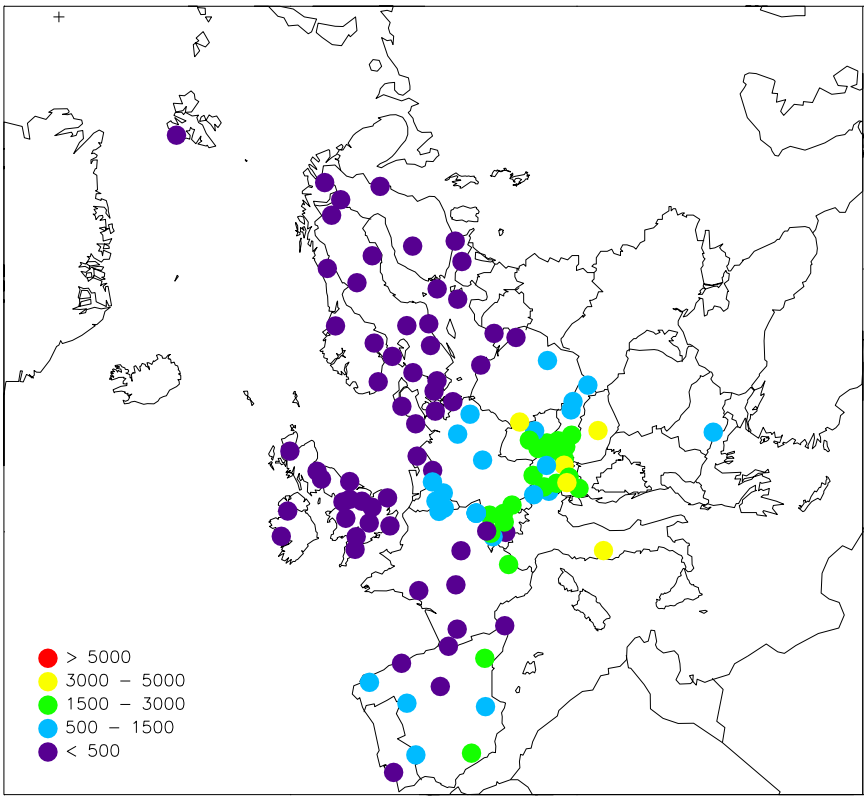


Figure 2.3: AOT60 (ppbh) April-September 2007 (daylight hours).

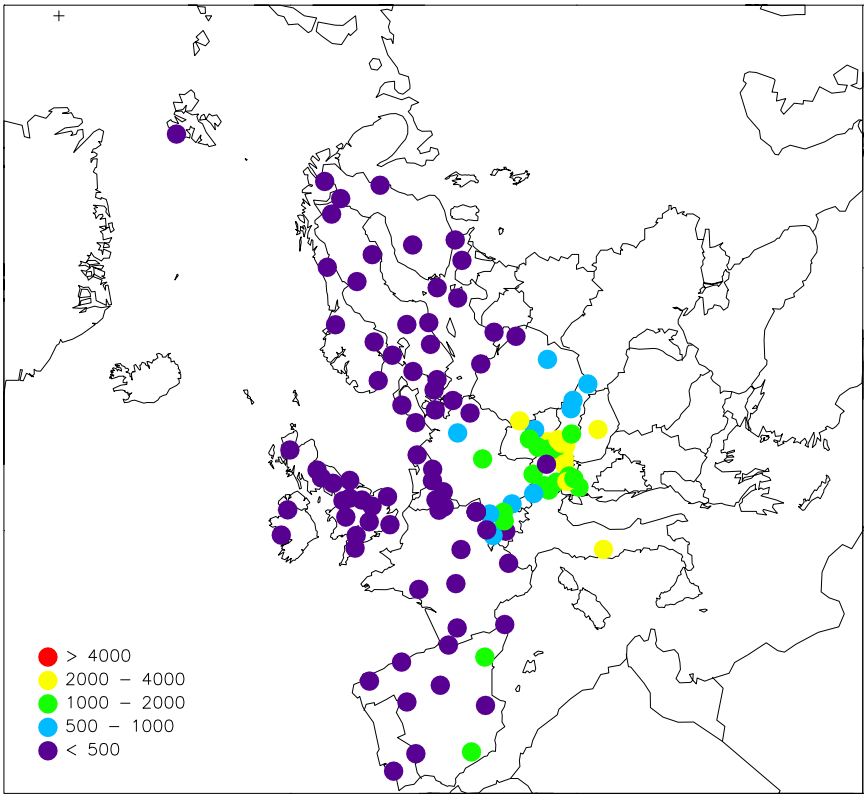


Figure 2.4: AOT60 (ppbh) May, June and July 2007 (daylight hours).

Table 2.1: AOT40 and AOT60 April–September 2007 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT0002R	Illmitz	16713	18614	2908	3239	90
AT0005R	Vorhegg	13567	14867	1402	1536	91
AT0030R	Pillersdorf bei Retz	16572	17880	2836	3060	93
AT0032R	Sulzberg	17635	18282	1894	1964	96
AT0034G	Sonnblick	27928	30713	2480	2727	91
AT0037R	Zillertaler Alpen	19304	19448	1241	1250	99
AT0038R	Gerlitzen	26194	27356	2373	2478	96
AT0040R	Masenberg	20434	22475	2653	2918	91
AT0041R	Haunsberg	15881	17243	2267	2461	92
AT0042R	Heidenreichstein	15775	16645	1805	1905	95
AT0043R	Forsthof	16494	18504	2250	2524	89
AT0044R	Graz Platte	20227	21216	3198	3354	95
AT0045R	Dunkelsteinerwald	13618	14399	2441	2580	95
AT0046R	Gänserndorf	16849	17873	2751	2918	94
AT0047R	Stixneusiedl	16591	17358	2759	2887	96
AT0048R	Zoebelboden	12622	14215	933	1050	89
BE0001R	Offagne	8056	8553	717	761	94
BE0032R	Eupen	5934	6561	845	934	90
BE0035R	Vezin	5725	6097	789	840	94
BG0053R	Rojen peak	9611	11269	1113	1304	85
CH0001G	Jungfraujoch	6329	6612	1	1	96
CH0002R	Payerne	12366	13155	1353	1440	94
CH0003R	Tänikon	13853	14546	2138	2245	95
CH0004R	Chaumont	15819	17300	1699	1858	91
CH0005R	Rigi	16711	17620	2265	2388	95
CY0002R	Ayia Marina	29537	32566	2502	2758	91
CZ0001R	Svratouch	10441	10441	665	665	100
CZ0003R	Košetice	15522	16018	1518	1566	97
DE0001R	Westerland	7085	7457	295	311	95
DE0002R	Langenbrügge	9928	10489	1226	1295	95
DE0003R	Schauinsland	16406	16676	1579	1605	98
DE0007R	Neuglobsow	8987	9084	744	752	99
DE0008R	Schmücke	12067	13964	1487	1720	86
DE0009R	Zingst	3653	3856	69	72	95
DK0005R	Keldsnor	2969	3007	15	15	99
DK0031R	Ulborg	4248	4477	101	106	95
DK0041R	Lille Valby	5421	5772	222	237	94
EE0009R	Lahemaa	1739	1763	6	6	99
EE0011R	Vilsandi	2060	2096	3	3	98
ES0007R	Viznar	23905	25306	1976	2092	94
ES0008R	Niembro	7852	7998	218	222	98
ES0009R	Campisabalos	12089	12608	231	241	96
ES0010R	Cabo de Creus	12752	12983	480	488	98
ES0011R	Barcarrola	11978	12520	519	542	96
ES0012R	Zarra	14916	15391	550	567	97
ES0013R	Penausende	14722	15584	723	765	94
ES0014R	Els Torms	20867	21892	2296	2409	95
ES0016R	O Saviñao	10328	10795	1144	1195	96
FI0009R	Utö	3922	3944	1	1	99
FI0017R	Virolahti II	2892	2916	8	8	99
FI0022R	Oulanka	1184	1193	0	0	99
FI0037R	Ahtari II	3267	3466	23	24	94
FI0096G	Pallas (Sammaltunturi)	2180	2335	0	0	93
FR0008R	Donon A	13418	13571	1074	1086	99
FR0008R	Donon B	14184	14360	1267	1282	99
FR0008R	Donon C	14490	14655	1313	1328	99
FR0008R	Donon D	11474	11617	772	781	99
FR0009R	Revin	8215	8543	1053	1095	96
FR0010R	Morvan	4602	5173	76	85	89
FR0012R	Iraty	11671	12055	372	384	97
FR0013R	Peyrusse Vieille	3919	4055	16	17	97
FR0014R	Montandon	3957	4202	126	134	94
FR0015R	La Tardière	5665	5792	67	69	98
FR0016R	Le Casset	24615	25185	1880	1923	98
FR0017R	Montfranc	8377	8754	421	440	96

Table 2.1, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
GB0002R	Eskdalemuir	1931	1965	18	18	98
GB0006R	Lough Navar	975	998	0	0	98
GB0013R	Yarner Wood	4084	4367	139	149	94
GB0014R	High Muffles	2665	2737	64	66	97
GB0015R	Strath Vaich Dam	3405	3766	51	56	90
GB0031R	Aston Hill	2838	2910	30	31	98
GB0032R	Bottesford	2453	2473	107	108	99
GB0033R	Bush	988	1004	0	0	98
GB0034R	Glazebury	2005	2110	62	65	95
GB0036R	Harwell	2159	2552	123	145	85
GB0037R	Ladybower Res.	2915	2958	111	113	99
GB0038R	Lullington Heath	3273	3474	106	113	94
GB0039R	Sibton	2084	2282	73	80	91
GB0044R	Somerton	3235	3510	53	58	92
GB0045R	Wicken Fen	4241	4350	208	213	97
HU0002R	K-puszta	24259	24342	4240	4254	100
IE0031R	Mace Head	4750	4861	182	186	98
IT0001R	Montelibretti	22037	22247	4790	4836	99
LT0015R	Preila	3625	3723	30	30	97
NL0007R	Eibergen	3327	3394	236	241	98
NL0009R	Kollumerwaard	6478	6601	489	498	98
NL0010R	Vredepeel	5472	5659	1122	1161	97
NO0001R	Birkenes	4720	4734	45	45	100
NO0015R	Tustervatn	2277	2297	0	0	99
NO0039R	Kårvatn	2204	2222	0	0	99
NO0042G	Spitsbergen, Zeppelinfjell	926	982	0	0	94
NO0043R	Prestebakke	4017	4038	43	43	99
NO0055R	Karasjok	1569	1572	0	0	100
NO0056R	Hurdal	2310	2319	1	1	100
PL0002R	Jarczew	11420	11499	775	780	99
PL0003R	Sniezka	26259	26284	3616	3619	100
PL0004R	Leba	8191	8190	153	152	100
PL0005R	Diabla Gora	6969	7427	363	386	94
PT0004R	Monte Velho	3605	3650	19	20	99
SE0005R	Bredkälen	2632	2803	0	0	94
SE0011R	Vavihill	5494	5891	209	224	93
SE0012R	Aspvreten	6547	7120	180	195	92
SE0013R	Esrange	2445	2451	1	1	100
SE0014R	Råö	4982	5001	123	123	100
SE0032R	Norra-Kvill	5316	5610	87	92	95
SE0035R	Vindeln	1969	1980	1	1	99
SE0039R	Grimsö	3862	3886	63	63	99
SI0008R	Iskbra	20330	21232	2674	2793	96
SI0031R	Zarodnje	16929	16986	1834	1840	100
SI0032R	Krvavec	28082	30587	3784	4121	92
SK0002R	Chopok	21963	22394	1459	1487	98
SK0004R	Stará Lesná	17113	17138	1218	1219	100
SK0006R	Starina	14283	15061	1155	1217	95
SK0007R	Topolniky	19679	19883	2561	2587	99

Table 2.2: AOT40 and AOT60 May–July 2007 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT0002R	Illmitz	10651	11926	2260	2531	89
AT0005R	Vorhegg	8820	9851	1111	1240	90
AT0030R	Pillersdorf bei Retz	10263	11003	2106	2258	93
AT0032R	Sulzberg	10142	10417	921	946	97
AT0034G	Sonnblick	16237	17303	1411	1503	94
AT0037R	Zillertaler Alpen	10574	10662	702	708	99
AT0038R	Gerlitzen	15936	16469	1651	1706	97
AT0040R	Masenberg	12497	13896	2043	2272	90
AT0041R	Haunsberg	9713	10776	1479	1640	90
AT0042R	Heidenreichstein	9501	10023	1254	1323	95
AT0043R	Forsthof	10324	11350	1776	1953	91
AT0044R	Graz Platte	13215	13794	2515	2625	96
AT0045R	Dunkelsteinerwald	7728	8138	1750	1843	95
AT0046R	Gänserdorf	10592	11325	2087	2231	94
AT0047R	Stixneusiedl	10246	10782	2081	2189	95
AT0048R	Zoebelboden	6743	7869	327	381	86
BE0001R	Offagne	3591	3926	140	152	91
BE0032R	Eupen	2585	2700	215	224	96
BE0035R	Vezin	2749	2836	329	339	97
CH0001G	Jungfraujoch	3475	3671	1	1	95
CH0002R	Payerne	6299	6693	542	576	94
CH0003R	Tänikon	7995	8439	1156	1220	95
CH0004R	Chaumont	7294	8217	539	607	89
CH0005R	Rigi	9084	9616	1048	1109	94
CY0002R	Ayia Marina	15319	16634	1634	1774	92
CZ0001R	Svratouch	6459	6459	515	515	100
CZ0003R	Košetice	9106	9577	1092	1149	95
DE0001R	Westerland	4401	4588	62	65	96
DE0002R	Langenbrügge	6344	6663	830	872	95
DE0003R	Schauinsland	9179	9348	747	760	98
DE0007R	Neuglobsow	5065	5136	315	320	99
DE0008R	Schmücke	7867	8188	1004	1045	96
DE0009R	Zingst	1997	2118	1	1	94
DK0005R	Keldsnor	1833	1865	7	7	98
DK0031R	Ulborg	2569	2757	19	21	93
DK0041R	Lille Valby	3489	3563	136	139	98
EE0009R	Lahemaa	991	1015	0	0	98
EE0011R	Vilsandi	1580	1586	3	3	100
ES0007R	Viznar	12473	13292	1150	1225	94
ES0008R	Niembro	3196	3246	44	44	98
ES0009R	Campisabalos	5703	5882	158	163	97
ES0010R	Cabo de Creus	6003	6116	218	222	98
ES0011R	Barcarrola	5007	5251	45	47	95
ES0012R	Zarra	7858	8013	304	310	98
ES0013R	Penausende	6286	6500	119	123	97
ES0014R	Els Torms	10988	11746	1280	1368	94
ES0016R	O Saviñao	3130	3197	68	69	98
FI0009R	Utö	2466	2466	1	1	100
FI0017R	Virolahti II	1919	1931	0	0	99
FI0022R	Oulanka	391	395	0	0	99
FI0037R	Ahtari II	2741	2792	23	23	98
FI0096G	Pallas (Sammaltunturi)	1270	1402	0	0	91
FR0008R	Donon A	6101	6134	336	338	99
FR0008R	Donon B	6551	6587	432	434	99
FR0008R	Donon C	6769	6800	460	462	100
FR0008R	Donon D	5114	5147	224	225	99
FR0009R	Revin	3129	3246	192	199	96
FR0010R	Morvan	2483	2504	39	39	99
FR0012R	Iraty	4458	4659	70	73	96
FR0013R	Peyrusse Vieille	1433	1478	2	2	97
FR0014R	Montandon	1877	1979	12	13	95
FR0015R	La Tardière	2011	2048	16	16	98
FR0016R	Le Casset	10997	11464	366	381	96
FR0017R	Montfranc	2715	2863	49	51	95

Table 2.2, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
GB0002R	Eskdalemuir	792	801	0	0	99
GB0006R	Lough Navar	691	700	0	0	99
GB0013R	Yarner Wood	1756	1813	133	137	97
GB0014R	High Muffles	1580	1628	43	44	97
GB0015R	Strath Vaich Dam	2412	2485	44	45	97
GB0031R	Aston Hill	1150	1177	12	12	98
GB0032R	Bottesford	1210	1220	40	40	99
GB0033R	Bush	401	407	0	0	98
GB0034R	Glazebury	1111	1133	46	47	98
GB0035R	Great Dun Fell	1097	1123	12	12	98
GB0036R	Harwell	1502	1562	92	96	96
GB0037R	Ladybower Res.	1325	1337	52	52	99
GB0038R	Lullington Heath	1445	1555	34	37	93
GB0039R	Sibton	884	945	0	0	94
GB0044R	Somerton	1521	1551	49	50	98
GB0045R	Wicken Fen	2044	2062	39	39	99
HU0002R	K-puszta	14211	14250	2710	2717	100
IE0031R	Mace Head	2611	2709	79	82	96
IT0001R	Montelibretti	13801	13840	3421	3431	100
LT0015R	Preila	2517	2546	13	13	99
NL0007R	Eibergen	1589	1613	32	33	99
NL0009R	Kollumerwaard	3970	4038	223	227	98
NL0010R	Vredepeel	2525	2588	370	379	98
NO0001R	Birkenes	2416	2422	26	26	100
NO0015R	Tustervatn	1166	1170	0	0	100
NO0039R	Kårvatn	1438	1447	0	0	99
NO0042G	Spitsbergen, Zeppelinfjell	739	785	0	0	94
NO0043R	Prestebakke	2692	2697	43	43	100
NO0055R	Karasjok	790	793	0	0	100
NO0056R	Hurdal	1517	1522	1	1	100
PL0002R	Jarczew	7739	7760	597	599	100
PL0003R	Sniezka	16054	16082	2268	2271	100
PL0004R	Leba	5291	5291	74	74	100
PL0005R	Diabla Gora	4966	5095	259	266	97
PT0004R	Monte Velho	1494	1526	17	17	98
SE0005R	Bredkälen	1964	2184	0	0	90
SE0011R	Vavihill	3278	3534	76	81	93
SE0012R	Aspvreten	4474	4979	179	199	90
SE0013R	Esrange	1294	1298	0	0	100
SE0014R	Råö	3488	3500	100	100	100
SE0032R	Norra-Kvill	2945	3222	61	66	91
SE0035R	Vindeln	1097	1106	1	1	99
SE0039R	Grimsö÷	2220	2241	3	3	99
SI0008R	Iskbra	11938	12550	1896	1993	95
SI0031R	Zarodnje	11380	11390	1473	1474	100
SI0032R	Krvavec	16728	18545	2646	2934	90
SI0033R	Kovk	11766	13018	1920	2124	90
SK0002R	Chopok	12681	12774	977	984	99
SK0004R	Stará Lesná	9721	9720	754	754	100
SK0006R	Starina	8290	8860	774	827	94
SK0007R	Topolniky	12131	12241	1891	1908	99

Annex 3

Seasonal variation

Table 3.1: Monthly mean concentrations 2007 ($\mu g/m^3$).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT0002R	Illmitz	39.6	43.6	64.9	81.4	81.6	84.4	89.4	77.9	54.1	42.5	43.7	30.1
AT0005R	Vorhegg	62.0	76.1	85.2	98.6	93.0	78.5	95.5	67.8	64.4	42.6	56.4	57.2
AT0030R	Pillersdorf bei Retz	49.1	47.7	71.3	94.5	86.6	84.9	89.5	79.7	59.2	44.4	42.5	31.9
AT0032R	Sulzberg	62.7	75.9	90.0	111.2	99.6	95.0	92.8	83.9	74.2	53.9	55.2	66.0
AT0034G	Sonnblick	82.9	93.6	104.2	122.4	116.6	114.0	106.8	109.5	92.5	94.0	85.3	85.5
AT0037R	Zillertaler Alpen	75.9	90.0	99.5	116.2	104.9	98.8	97.1	95.9	80.7	77.3	77.3	79.8
AT0038R	Gerlitzen	76.1	87.6	98.6	117.0	111.9	111.4	110.3	106.9	86.2	81.2	78.9	80.5
AT0040R	Masenberg	59.3	69.2	87.8	108.4	98.0	103.5	106.3	97.6	72.7	62.3	58.6	66.5
AT0041R	Haunsberg	56.9	61.3	77.5	100.2	94.2	90.7	96.1	84.8	58.6	38.7	34.5	39.0
AT0042R	Heidenreichstein	54.4	48.7	67.7	87.3	83.0	84.0	83.3	73.0	55.3	37.3	41.6	36.8
AT0043R	Forsthof	55.9	52.8	76.7	99.5	92.9	93.8	98.7	85.1	62.8	44.0	44.1	35.1
AT0044R	Graz Platte	51.9	57.2	83.4	104.6	95.6	101.0	104.9	94.1	71.3	49.3	47.4	29.6
AT0045R	Dunkelsteinerwald	49.1	43.0	61.4	84.8	63.6	64.9	86.0	67.3	50.1	33.5	38.7	29.3
AT0046R	Gänserdorf	39.6	40.2	60.7	79.0	78.5	80.6	83.6	74.9	52.7	36.3	36.7	26.4
AT0047R	Stixneusiedl	43.4	43.7	64.2	85.4	80.1	83.9	91.1	81.0	57.0	39.5	40.0	29.6
AT0048R	Zoebelboden	64.5	70.1	86.0	104.9	97.2	91.6	86.0	84.7	65.7	52.7	57.6	64.0
AT0049R	Grebenzen bei St. Lamprecht	73.3	82.3	95.2	114.1	100.2	101.9	101.3	98.8	78.2	73.3	73.8	76.3
BE0001R	Offagne	50.7	47.1	61.0	83.4	70.9	66.6	59.5	55.1	43.3	37.9	37.0	40.3
BE0032R	Eupen	46.6	42.7	49.2	79.9	69.5	58.3	59.7	50.7	41.7	27.9	32.1	38.9
BE0035R	Vezin	43.6	36.0	48.5	56.8	61.1	55.0	50.5	43.5	33.2	15.5	25.9	28.6
BG0053R	Rojen peak	79.1	66.1	80.6	91.4	84.3	66.0	90.9	93.7	70.6	67.9	65.1	82.2
CH0001G	Jungfraujoch	61.2	67.3	74.8	89.2	81.9	83.1	78.3	79.8	73.8	69.6	62.8	65.5
CH0002R	Payerne	39.2	45.8	61.2	77.9	72.3	69.5	69.1	65.0	53.1	31.5	27.9	35.4
CH0003R	Tänikon	46.9	43.4	60.2	74.8	77.8	74.3	74.0	61.0	49.4	28.6	30.2	35.4
CH0004R	Chaumont	66.1	75.1	87.6	114.3	95.6	91.7	87.8	90.0	78.3	62.4	61.2	71.0
CH0005R	Rigi	64.4	74.4	86.5	109.1	95.6	91.9	92.4	85.7	75.2	53.9	54.9	70.4
CY0002R	Ayia Marina	86.8	91.7	103.6	116.1	98.1	113.2	115.6	107.7	109.6	96.8	83.9	78.9
CZ0001R	Svratouch	45.3	44.6	60.9	84.5	81.1	79.5	72.4	71.0	50.6	45.3	45.1	41.3
CZ0003R	Košetice	54.6	50.4	68.4	89.3	86.0	87.1	79.0	72.7	55.8	42.7	43.1	37.0
DE0001R	Westerland	69.5	48.7	71.5	84.6	85.3	82.5	72.5	74.2	62.6	53.3	54.0	46.1
DE0002R	Langenbrügge	49.9	40.9	59.8	79.0	72.3	65.7	61.6	57.2	47.5	33.7	34.0	35.8
DE0003R	Schauinsland	61.8	71.7	74.3	100.8	97.8	98.4	89.4	91.5	78.4	69.3	64.6	73.5
DE0007R	Neuglobsow	52.4	44.8	62.0	82.7	70.4	61.2	57.4	53.0	44.3	34.7	36.2	36.7
DE0008R	Schmücke	55.2	58.4	75.9	99.9	95.8	89.5	69.7	68.3	58.9	48.6	49.2	53.3
DE0009R	Zingst	56.3	46.0	61.9	76.2	72.0	66.9	61.0	60.6	47.6	44.7	41.6	37.9

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DK0005R	Keldsnor	60.1	50.7	66.6	78.0	77.2	73.1	60.5	61.5	48.9	50.0	44.9	40.6
DK0031R	Ulborg	62.9	48.1	68.6	81.1	77.6	75.2	64.5	68.1	57.0	50.8	55.0	50.4
DK0041R	Lille Valby	55.7	51.2	63.9	72.3	74.8	69.9	65.4	66.1	48.2	41.6	44.6	35.0
EE0009R	Lahemaa	52.5	57.9	58.6	71.7	69.0	62.9	56.8	59.2	41.8	39.6	42.7	41.2
EE0011R	Vilsandi	61.7	62.9	68.0	75.6	83.8	77.9	68.9	71.6	59.0	53.0	52.2	49.5
ES0007R	Viznar	67.1	66.6	90.3	97.3	94.9	90.9	103.1	103.1	97.3	88.6	79.6	68.1
ES0008R	Niembro	53.7	65.7	82.4	92.5	82.3	73.8	59.0	73.8	69.2	57.5	60.4	57.0
ES0009R	Campisabalos	55.9	67.1	77.4	82.6	76.3	72.6	74.2	79.7	71.6	58.5	58.7	58.4
ES0010R	Cabo de Creus	56.5	63.2	79.4	100.9	85.7	86.0	79.0	84.1	81.1	71.1	59.1	60.9
ES0011R	Barcarrola	33.1	47.2	60.8	69.1	66.0	64.2	73.8	79.4	72.6	54.5	56.4	41.5
ES0012R	Zarra	46.3	57.2	79.4	90.8	84.0	86.8	87.0	88.0	86.1	75.9	67.8	59.4
ES0013R	Penausende	49.1	62.0	77.0	89.2	83.1	79.8	80.0	86.4	86.6	79.9	78.2	69.4
ES0014R	Els Torms	41.1	60.2	83.9	91.2	92.3	96.5	88.8	93.1	85.2	66.1	58.2	50.7
ES0016R	O Saviñao	45.9	59.5	72.0	96.0	73.0	70.9	57.0	69.7	70.6	58.8	45.2	41.3
FI0009R	Utö	63.6	64.4	61.4	77.2	77.3	75.3	67.3	73.2	58.9	56.8	59.8	52.8
FI0017R	Virolahti II	49.5	53.8	55.5	67.3	66.8	59.4	54.4	51.5	40.0	38.9	44.6	39.5
FI0022R	Oulanka	60.3	66.9	79.3	80.3	71.6	52.4	41.3	43.3	42.4	46.6	50.4	50.2
FI0037R	Ahtari II	55.0	55.7	68.2	70.3	69.5	73.2	60.4	49.9	37.3	47.9	46.6	43.9
FI0096G	Pallas (Sammaltunturi)	67.1	70.3	84.2	81.3	79.2	68.9	56.5	58.0	51.9	54.6	60.2	64.2
FR0008R	Donon A	56.8	63.5	76.4	104.9	87.9	84.0	78.3	82.1	67.4	55.3	52.9	59.2
FR0008R	Donon B	57.2	64.0	77.1	106.1	89.3	86.0	79.4	83.7	68.8	56.5	53.8	59.7
FR0008R	Donon C	57.4	64.5	77.4	106.5	89.9	87.0	80.3	84.9	69.8	57.1	54.3	62.1
FR0008R	Donon D	55.9	62.3	74.7	103.3	85.9	81.4	75.8	79.0	64.7	53.5	51.7	58.0
FR0009R	Revin	49.3	47.5	67.4	91.7	69.2	65.3	60.7	57.6	48.1	37.7	38.0	38.1
FR0010R	Morvan	50.2	60.7	66.5	76.1	68.2	67.0	58.5	59.9	49.5	43.4	41.6	56.6
FR0012R	Iraty	75.8	83.0	97.4	112.4	86.8	90.5	78.1	90.8	83.3	76.4	74.8	77.0
FR0013R	Peyrusse Vieille	44.8	51.4	63.4	64.9	53.1	67.2	54.7	66.7	63.2	45.8	46.9	42.4
FR0014R	Montandon	53.8	69.3	49.3	58.9	60.3	45.6	63.8	68.0	45.9	51.6	68.4	50.4
FR0015R	La Tardière	44.7	51.5	59.8	77.0	63.5	67.0	53.9	61.1	58.1	40.4	40.2	41.0
FR0016R	Le Casset	78.3	87.3	103.4	124.5	99.1	96.6	100.1	94.4	97.4	82.9	81.0	86.1
FR0017R	Montfranc	62.4	71.2	81.7	103.2	73.6	76.2	64.0	68.7	70.3	59.9	55.0	64.5

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB0002R	Eskdalemuir	65.2	49.3	71.6	70.9	59.2	60.9	48.6	45.8	46.3	38.6	49.7	46.3
GB0006R	Lough Navar	54.0	41.6	54.9	54.8	55.1	47.9	38.7	34.9	33.6	36.7	49.7	48.1
GB0013R	Yarner Wood	66.5	54.9	75.0	79.5	68.7	61.9	53.8	56.2	48.2	41.6	49.6	49.4
GB0014R	High Muffles	55.5	43.7	66.0	71.9	66.5	65.6	49.1	49.5	44.2	36.3	42.4	43.8
GB0015R	Strath Vaich Dam	82.1	65.5	80.7	85.1	80.4	73.9	57.6	53.9	56.5	61.8	70.0	65.9
GB0031R	Aston Hill	70.4	62.0	78.2	81.8	69.9	66.4	53.5	53.5	52.3	48.8	59.9	72.3
GB0032R	Bottesford	49.0	35.7	53.3	57.3	54.6	54.3	43.3	44.5	40.3	33.5	39.7	38.7
GB0033R	Bush	63.1	49.3	69.7	70.9	66.1	58.5	48.7	45.8	49.6	46.5	52.1	47.0
GB0034R	Glazebury	-	-	-	55.5	52.1	51.3	39.2	42.4	39.5	22.2	36.0	34.3
GB0035R	Great Dun Fell	61.8	55.3	76.3	79.4	71.9	72.3	55.9	50.5	47.7	49.3	52.5	58.1
GB0036R	Harwell	54.4	41.5	64.4	65.3	65.3	59.0	49.6	48.5	44.1	31.4	39.4	40.6
GB0037R	Ladybower Res.	41.1	39.3	74.3	75.4	65.5	61.9	51.7	49.9	46.7	33.8	48.5	46.2
GB0038R	Lullington Heath	54.9	50.2	62.0	72.9	68.3	65.5	55.2	52.1	46.9	37.4	45.0	44.4
GB0039R	Sibton	51.8	37.9	56.7	61.2	64.1	58.2	51.4	51.8	45.5	39.8	37.5	39.7
GB0044R	Somerton	58.6	50.5	65.7	70.8	65.9	62.0	49.2	50.7	46.2	37.4	41.7	40.5
GB0045R	Wicken Fen	57.7	43.4	57.6	62.1	62.5	61.6	50.2	50.6	44.9	41.7	-	-
GR0002R	Finokalia	94.3	92.8	-	129.9	121.1	120.8	133.2	124.8	106.6	113.8	84.3	89.2
HU0002R	K-puszta	44.3	44.1	67.3	91.6	82.8	85.7	89.9	85.6	54.2	42.1	36.1	26.4
IE0031R	Mace Head	79.5	73.2	88.4	87.0	83.2	72.9	61.6	60.0	62.1	68.3	75.1	72.1
IT0001R	Montelibretti	22.9	35.0	52.0	59.2	62.5	67.1	79.6	73.8	62.3	38.5	25.9	25.8
IT0004R	Ispra	10.7	16.1	45.0	62.6	55.5	59.2	49.4	30.5	24.9	13.4	12.1	9.1
LT0015R	Preila	60.3	56.9	66.1	74.6	73.8	71.6	68.4	65.9	51.7	47.3	43.1	34.4
LV0010R	Rucava	46.8	56.4	59.0	62.1	64.1	60.9	58.4	57.2	45.5	39.6	39.2	30.6
MT0001R	Giordan lighthouse	87.4	82.2	91.2	103.5	93.7	83.8	-	86.7	94.0	70.3	82.4	79.5
NL0007R	Eibergen	38.7	26.8	47.2	62.2	53.1	47.7	39.6	41.1	26.5	16.3	21.5	20.5
NL0009R	Kollumerwaard	46.5	33.0	60.2	72.8	76.9	71.3	59.1	62.5	49.0	35.8	41.5	35.6
NL0010R	Vredepeel	36.0	25.9	46.8	67.0	59.8	52.2	40.3	35.4	28.3	15.2	19.8	24.1
NO0001R	Birkenes	64.5	59.9	71.8	73.6	65.2	62.7	49.3	52.8	47.4	36.6	47.9	39.5
NO0015R	Tustervatn	70.8	71.2	87.7	83.4	79.1	61.3	50.5	54.3	53.3	61.9	67.1	69.2
NO0039R	Kørvatn	62.6	65.9	76.0	68.0	66.1	50.2	43.3	35.5	42.8	35.5	52.8	52.4
NO0042G	Spitsbergen, Zeppelinfjell	72.8	79.1	84.4	55.8	69.7	64.3	51.1	55.2	63.8	71.8	77.0	74.7
NO0043R	Prestebakke	58.2	56.5	65.4	72.0	70.9	72.3	52.9	59.5	49.3	43.3	46.8	46.9
NO0052R	Sandve	65.3	58.3	72.4	71.4	69.8	67.0	61.1	63.9	56.3	55.5	54.3	54.6

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NO0055R	Karasjok	66.7	71.3	85.5	78.7	76.7	62.2	48.9	47.0	44.8	49.3	59.8	64.4
NO0056R	Hurdal	47.9	50.1	65.7	67.0	65.6	62.4	42.2	47.0	42.9	32.3	39.6	39.2
PL0002R	Jarczew	46.2	45.1	65.6	69.4	72.8	66.0	67.1	63.0	39.0	33.4	30.6	27.3
PL0003R	Sniezka	74.9	77.5	93.8	117.6	115.4	110.0	105.7	105.3	81.9	72.2	71.5	77.5
PL0004R	Leba	59.6	64.1	74.7	85.1	86.0	79.8	73.5	71.7	61.8	59.0	56.6	52.8
PL0005R	Diabla Gora	54.3	62.4	72.5	78.0	74.1	65.8	61.9	59.5	46.9	39.5	47.0	35.3
PT0004R	Monte Velho	35.0	53.3	68.6	74.1	70.9	65.0	-	-	-	-	-	-
SE0005R	Bredkälen	61.4	62.1	75.1	76.6	76.7	75.6	54.5	54.2	50.3	48.3	57.8	60.2
SE0011R	Vavihill	56.6	53.1	67.1	80.5	74.9	73.4	60.9	62.4	43.6	49.7	47.6	42.4
SE0012R	Aspvreten	60.2	66.5	69.3	79.2	81.4	73.1	52.4	56.5	46.0	39.1	42.2	41.8
SE0013R	Esrange	65.6	70.8	88.1	83.7	77.5	65.9	55.3	54.4	48.8	53.8	57.3	59.3
SE0014R	Råö	42.3	53.4	63.8	70.3	76.6	77.4	67.9	70.3	55.8	46.3	49.2	45.2
SE0032R	Norra-Kvill	58.6	61.3	73.9	86.0	79.9	72.8	48.1	63.5	40.8	47.6	46.6	43.9
SE0035R	Vindeln	46.5	55.9	65.3	75.0	69.9	57.1	44.9	41.9	36.8	33.6	47.9	46.2
SE0039R	Grimsö	61.0	63.4	65.5	72.8	72.6	64.9	52.8	54.6	43.6	36.5	42.9	38.7
SI0008R	Iskrba	44.7	47.7	65.8	72.1	68.2	65.9	72.4	53.8	45.7	34.7	42.6	35.0
SI0031R	Zarodnje	45.2	60.6	81.3	98.6	92.0	94.0	100.3	80.5	64.6	47.4	47.1	33.4
SI0032R	Krvavec	73.2	85.3	99.7	120.8	113.9	114.1	117.5	111.4	86.9	82.1	76.2	77.9
SI0033R	Kovk	45.8	59.1	81.4	120.7	94.5	90.9	105.0	79.2	53.6	40.4	43.6	33.9
SK0002R	Chopok	72.0	79.3	98.1	107.5	106.0	104.4	103.4	106.3	84.2	83.1	74.4	81.1
SK0004R	Stará Lesná	52.5	60.7	80.0	94.5	88.2	75.4	79.9	77.2	58.5	52.9	56.1	41.8
SK0006R	Starina	45.1	55.0	74.4	85.2	78.5	74.7	77.3	73.8	52.2	48.4	48.1	43.6
SK0007R	Topolniky	39.9	43.2	65.9	80.6	76.6	80.1	83.5	71.7	54.0	41.0	36.6	27.4

Table 3.2: Monthly data capture 2007 ($\mu g/m^3$).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT0002R	Illmitz	95	95	95	95	79	95	95	95	93	95	94	94
AT0005R	Vorhegg	91	96	94	95	83	95	92	95	95	81	96	96
AT0030R	Pillersdorf bei Retz	93	95	95	93	94	95	95	95	96	96	95	95
AT0032R	Sulzberg	94	95	94	90	94	96	95	98	93	95	96	79
AT0034G	Sonnblick	96	96	90	95	96	95	93	92	86	31	94	96
AT0037R	Zillertaler Alpen	96	96	96	96	96	96	97	96	96	96	96	96
AT0038R	Gerlitzen	90	90	88	92	95	96	96	95	96	96	96	96
AT0040R	Masenberg	25	95	95	92	96	95	87	95	95	95	95	95
AT0041R	Haunsberg	94	95	96	96	95	81	96	95	96	95	96	96
AT0042R	Heidenreichstein	95	96	96	96	96	95	95	96	95	95	96	96
AT0043R	Forsthof	95	95	91	96	92	91	93	96	68	89	95	95
AT0044R	Graz Platte	95	96	96	96	96	96	96	95	96	95	96	96
AT0045R	Dunkelsteinerwald	92	95	95	95	95	95	95	95	96	95	95	96
AT0046R	Gänserdorf	96	96	96	95	96	89	95	95	96	95	95	96
AT0047R	Stixneusiedl	96	96	96	96	95	96	95	96	95	96	96	95
AT0048R	Zoebelboden	92	95	94	95	95	94	74	94	95	95	92	95
AT0049R	Grebenzen bei St. Lamprecht	96	96	95	89	77	95	78	75	88	95	96	96
BE0001R	Offagne	93	94	68	97	97	95	87	98	98	98	83	97
BE0032R	Eupen	90	93	77	62	98	92	97	96	95	97	84	96
BE0035R	Vezin	93	92	95	73	97	98	97	98	98	83	97	97
BG0053R	Rojen peak	86	100	99	100	53	95	100	90	77	97	96	48
CH0001G	Jungfraujoch	97	97	98	97	96	93	98	98	97	98	97	98
CH0002R	Payerne	85	95	95	94	91	95	95	95	95	95	95	95
CH0003R	Tänikon	92	95	95	95	94	95	95	96	95	95	96	95
CH0004R	Chaumont	95	95	96	95	96	77	95	94	96	94	95	96
CH0005R	Rigi	92	91	95	95	96	95	94	95	95	96	95	96
CY0002R	Ayia Marina	87	99	99	98	95	96	91	82	82	97	97	96
CZ0001R	Svratouch	100	100	97	100	100	100	100	100	100	100	100	100
CZ0003R	Kosetice	100	100	94	100	89	78	100	98	100	100	100	100
DE0001R	Westerland	86	92	95	93	95	96	96	96	95	96	95	96
DE0002R	Langenbrügge	94	96	95	95	96	96	95	94	96	96	94	88
DE0003R	Schauinsland	96	96	96	96	96	96	96	96	96	96	96	96
DE0007R	Neuglobsow	100	99	99	100	99	99	100	100	100	99	95	96
DE0008R	Schmücke	93	96	96	96	96	96	96	41	95	95	95	87
DE0009R	Zingst	96	96	96	96	96	96	93	96	95	96	93	95

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DK0005R	Keldsnor	100	96	100	100	100	99	97	100	98	98	100	100
DK0031R	Ulborg	78	97	99	93	92	96	87	96	100	95	95	95
DK0041R	Lille Valby	100	100	100	98	100	95	100	90	78	100	98	100
EE0009R	Lahemaa	100	100	100	100	97	99	100	100	100	97	99	100
EE0011R	Vilsandi	99	100	86	99	99	100	100	96	100	98	100	100
ES0007R	Viznar	99	91	99	99	98	90	97	99	93	94	91	96
ES0008R	Niembro	99	99	99	99	99	100	99	99	99	98	99	99
ES0009R	Campisabalos	99	99	94	99	99	96	99	98	84	92	89	90
ES0010R	Cabo de Creus	98	99	98	99	99	98	98	100	98	90	88	98
ES0011R	Barcarrola	99	99	99	97	99	96	95	92	98	92	96	99
ES0012R	Zarra	99	99	99	97	94	99	99	96	95	89	99	99
ES0013R	Penausende	99	92	96	97	98	98	98	91	97	98	97	99
ES0014R	Els Torms	99	99	98	99	99	99	87	99	93	96	96	93
ES0016R	O Saviñao	99	99	99	95	99	99	99	97	92	91	98	99
FI0009R	Utö	100	100	100	100	100	100	100	99	100	100	100	100
FI0017R	Virolahti II	99	100	100	100	99	100	100	100	94	99	98	97
FI0022R	Oulanka	99	100	99	100	99	100	99	100	100	100	97	97
FI0037R	Ahtari II	99	99	97	100	96	100	100	93	68	76	97	98
FI0096G	Pallas (Sammaltunturi)	96	100	100	100	100	75	99	98	96	100	97	94
FR0008R	Donon A	98	98	94	95	99	98	98	99	98	88	90	85
FR0008R	Donon B	100	100	96	97	100	100	99	100	100	89	91	86
FR0008R	Donon C	100	100	96	97	100	100	99	100	100	95	91	93
FR0008R	Donon D	98	98	94	95	99	98	98	99	99	88	90	85
FR0009R	Revin	96	100	100	95	95	98	96	99	95	98	95	91
FR0010R	Morvan	100	100	92	36	100	100	99	99	100	98	66	38
FR0012R	Iraty	98	85	99	98	92	96	99	99	99	64	95	82
FR0013R	Peyrusse Vieille	96	89	100	94	100	91	100	94	96	93	96	95
FR0014R	Montandon	99	89	93	87	99	95	91	100	92	98	98	99
FR0015R	La Tardière	95	99	65	91	100	95	100	100	100	98	95	90
FR0016R	Le Casset	99	98	99	99	88	99	99	99	99	96	91	87
FR0017R	Montfranc	86	94	99	99	99	91	97	94	99	99	99	99

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB0002R	Eskdalemuir	99	92	100	100	100	99	99	96	100	100	100	99
GB0006R	Lough Navar	99	97	97	97	99	97	100	95	100	94	100	100
GB0013R	Yarner Wood	100	100	91	84	99	94	99	96	89	99	93	100
GB0014R	High Muffles	99	100	95	100	99	99	96	96	100	100	100	100
GB0015R	Strath Vaich Dam	60	95	96	45	100	95	94	100	97	82	98	92
GB0031R	Aston Hill	99	99	82	99	99	96	99	99	96	100	100	35
GB0032R	Bottesford	99	99	100	100	100	100	99	100	100	99	100	99
GB0033R	Bush	98	100	95	100	99	99	99	99	99	99	99	99
GB0034R	Glazebury	0	0	0	85	99	100	96	92	99	100	100	100
GB0035R	Great Dun Fell	98	87	92	98	100	95	99	4	68	99	99	99
GB0036R	Harwell	98	88	10	14	100	100	92	100	99	98	98	92
GB0037R	Ladybower Res.	96	97	95	100	99	99	100	100	96	100	100	100
GB0038R	Lullington Heath	92	99	99	94	99	93	88	100	95	100	98	100
GB0039R	Sibton	100	95	100	100	97	85	100	70	100	100	100	100
GB0044R	Somerton	99	96	100	100	99	100	97	91	62	99	99	92
GB0045R	Wicken Fen	99	99	93	99	99	99	100	99	91	15	0	0
GR0002R	Finokalia	100	36	0	17	49	89	96	98	73	21	51	15
HU0002R	K-puszta	100	100	96	100	100	99	100	100	97	100	100	100
IE0031R	Mace Head	95	100	100	100	100	88	100	100	97	100	99	98
IT0001R	Montelibretti	100	100	98	95	100	100	98	99	100	100	98	99
IT0004R	Ispra	100	98	96	97	95	5	94	80	96	88	99	90
LT0015R	Preila	94	100	84	100	100	97	100	92	98	100	100	92
LV0010R	Rucava	94	100	99	99	74	38	100	100	98	100	86	84
MT0001R	Giordan lighthouse	4	100	100	59	100	85	0	55	0	27	100	39
NL0007R	Eibergen	97	97	99	100	100	100	96	93	97	100	86	100
NL0009R	Kollumerwaard	100	99	98	97	100	96	98	99	98	99	99	100
NL0010R	Vredepeel	100	99	99	96	98	95	99	89	100	100	98	94
NO0001R	Birkenes	100	100	100	99	100	100	99	100	100	100	100	97
NO0015R	Tustervatn	99	99	100	99	100	100	100	99	100	100	100	98
NO0039R	Kårvatn	99	100	100	100	99	100	100	99	99	96	99	100
NO0042G	Spitsbergen, Zeppelinfjell	81	95	99	100	100	92	91	93	95	93	98	97
NO0043R	Prestebakke	98	100	100	99	100	100	100	100	100	100	100	89
NO0052R	Sandve	92	100	100	99	12	100	100	99	100	77	99	85

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	100	99	100	100	99	100	100
NO0056R	Hurdal	100	100	100	100	100	100	100	100	99	100	100	99
PL0002R	Jarczew	98	100	100	99	99	99	100	99	99	99	87	90
PL0003R	Sniezka	88	100	100	100	100	100	100	100	100	99	100	100
PL0004R	Leba	100	100	100	100	100	100	100	100	100	100	100	100
PL0005R	Diabla Gora	100	98	100	69	96	100	100	100	100	100	63	100
PT0004R	Monte Velho	100	100	100	100	100	15	0	0	0	0	0	0
SE0005R	Bredkälen	100	100	100	100	100	70	100	100	98	99	100	99
SE0011R	Vavihill	99	100	100	100	99	100	81	100	79	100	100	100
SE0012R	Aspvreten	90	92	93	98	99	92	78	94	92	85	99	93
SE0013R	Esrange	99	100	100	100	100	99	100	100	100	100	100	80
SE0014R	Råö	99	100	100	100	99	100	100	100	99	99	100	100
SE0032R	Norra-Kvill	73	99	99	97	96	100	79	100	100	100	100	100
SE0035R	Vindeln	94	100	99	99	97	99	100	100	100	99	100	98
SE0039R	Grimsö	95	100	100	100	99	100	100	100	100	99	100	100
SI0008R	Iskrba	100	100	100	100	100	99	100	97	93	100	100	100
SI0031R	Zarodnje	95	95	94	96	96	96	96	96	95	95	93	94
SI0032R	Krvavec	95	93	90	94	84	95	95	93	95	95	95	94
SI0033R	Kovk	60	95	86	15	96	91	85	91	91	96	95	93
SK0002R	Chopok	100	100	100	100	100	99	100	97	93	100	100	100
SK0004R	Stará Lesná	99	100	100	100	100	100	100	99	100	100	100	100
SK0006R	Starina	97	100	93	98	95	86	93	89	91	97	98	99
SK0007R	Topolniky	99	97	99	97	98	98	100	99	100	100	100	100

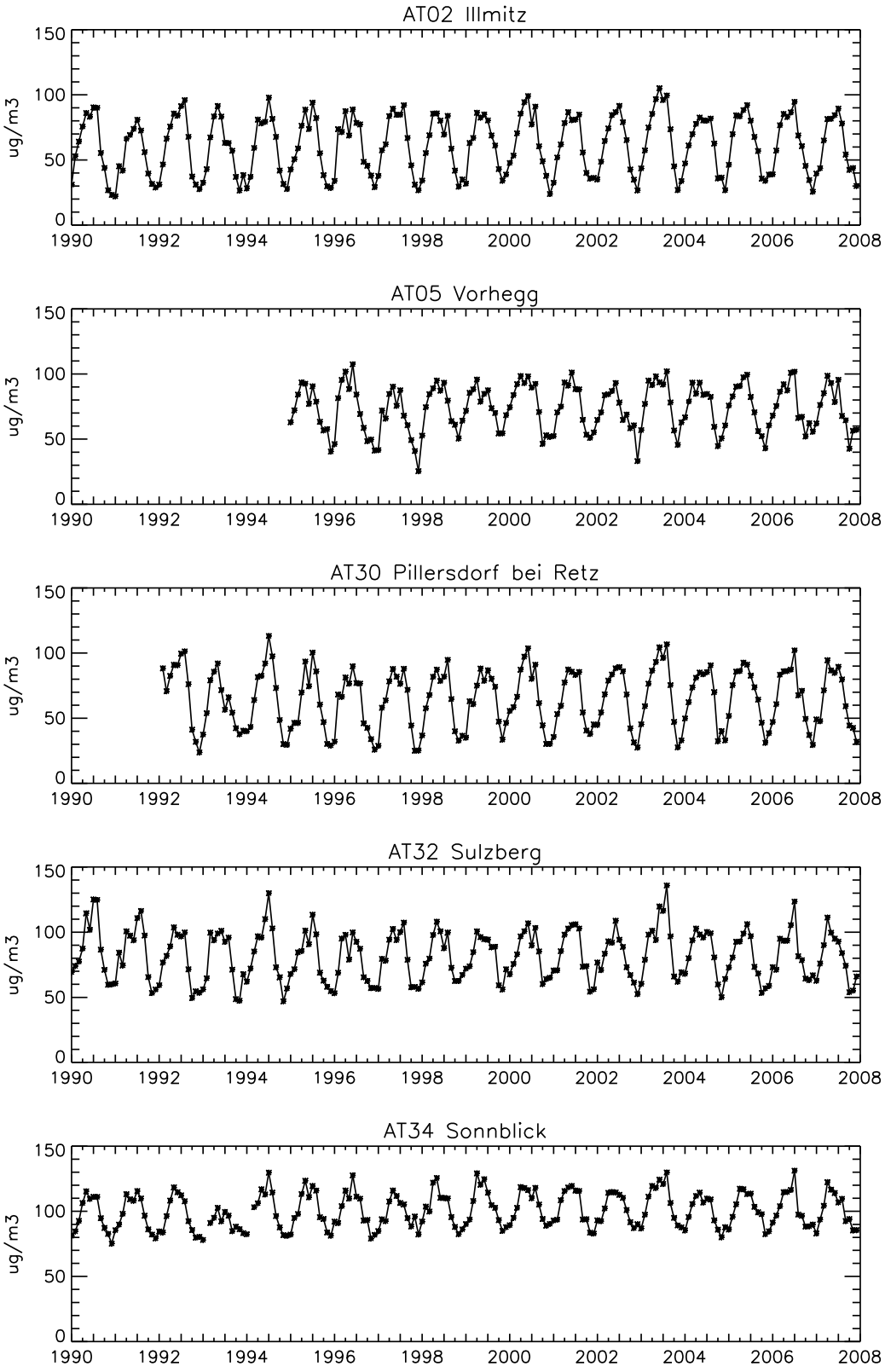


Figure 3.1: Seasonal variation, 1990–2007.

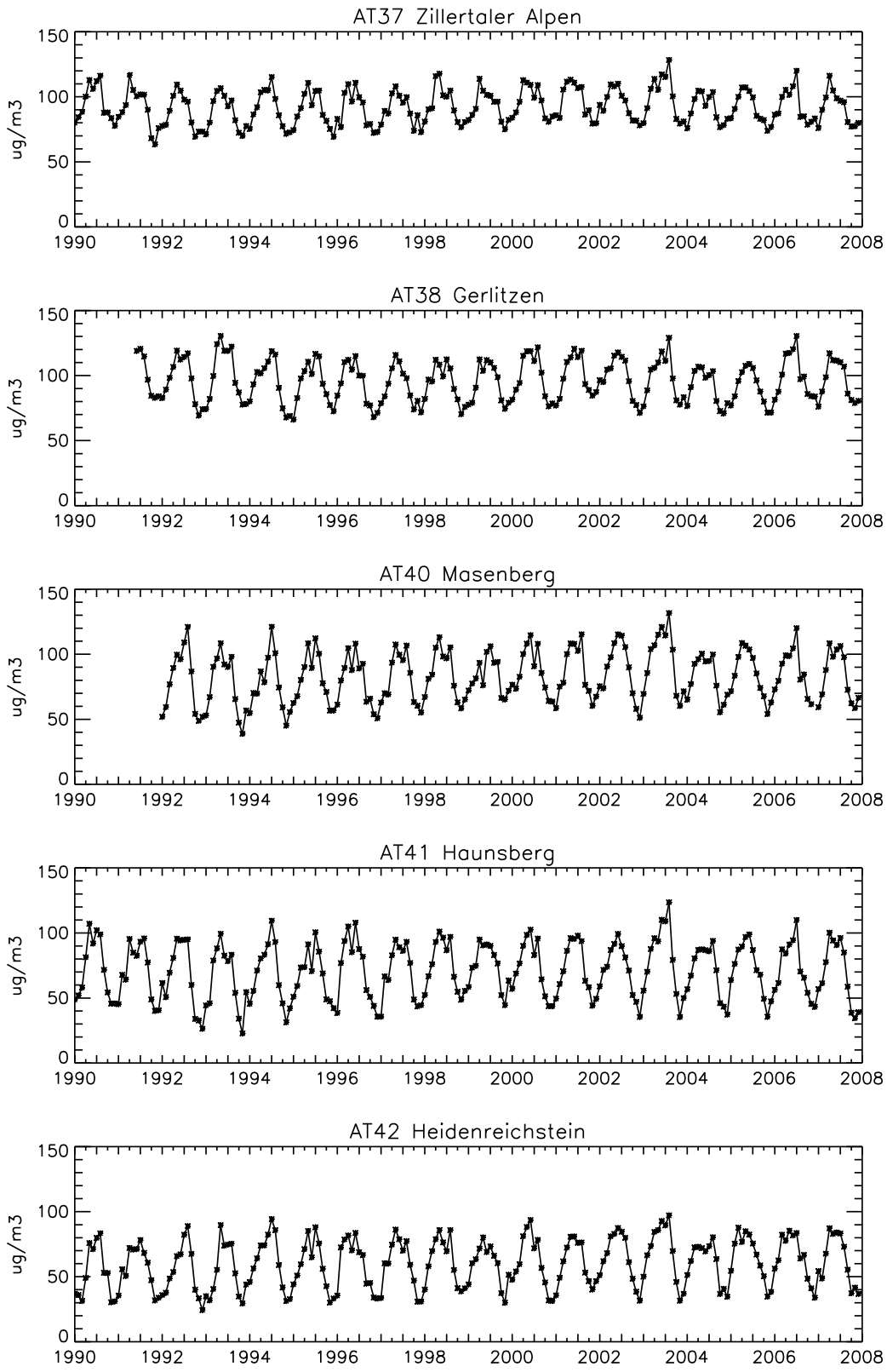


Figure 3.1, cont.

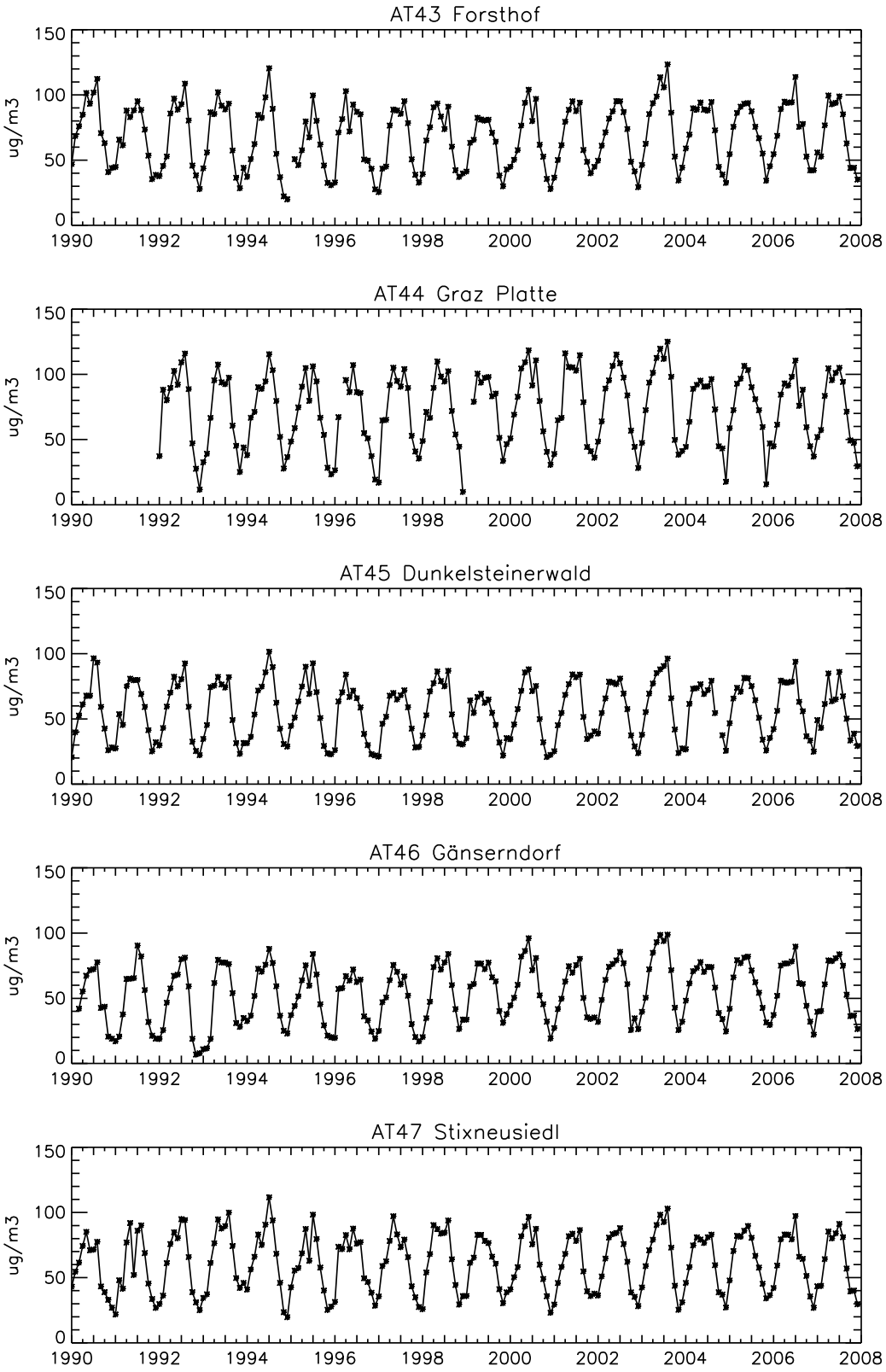


Figure 3.1, cont.

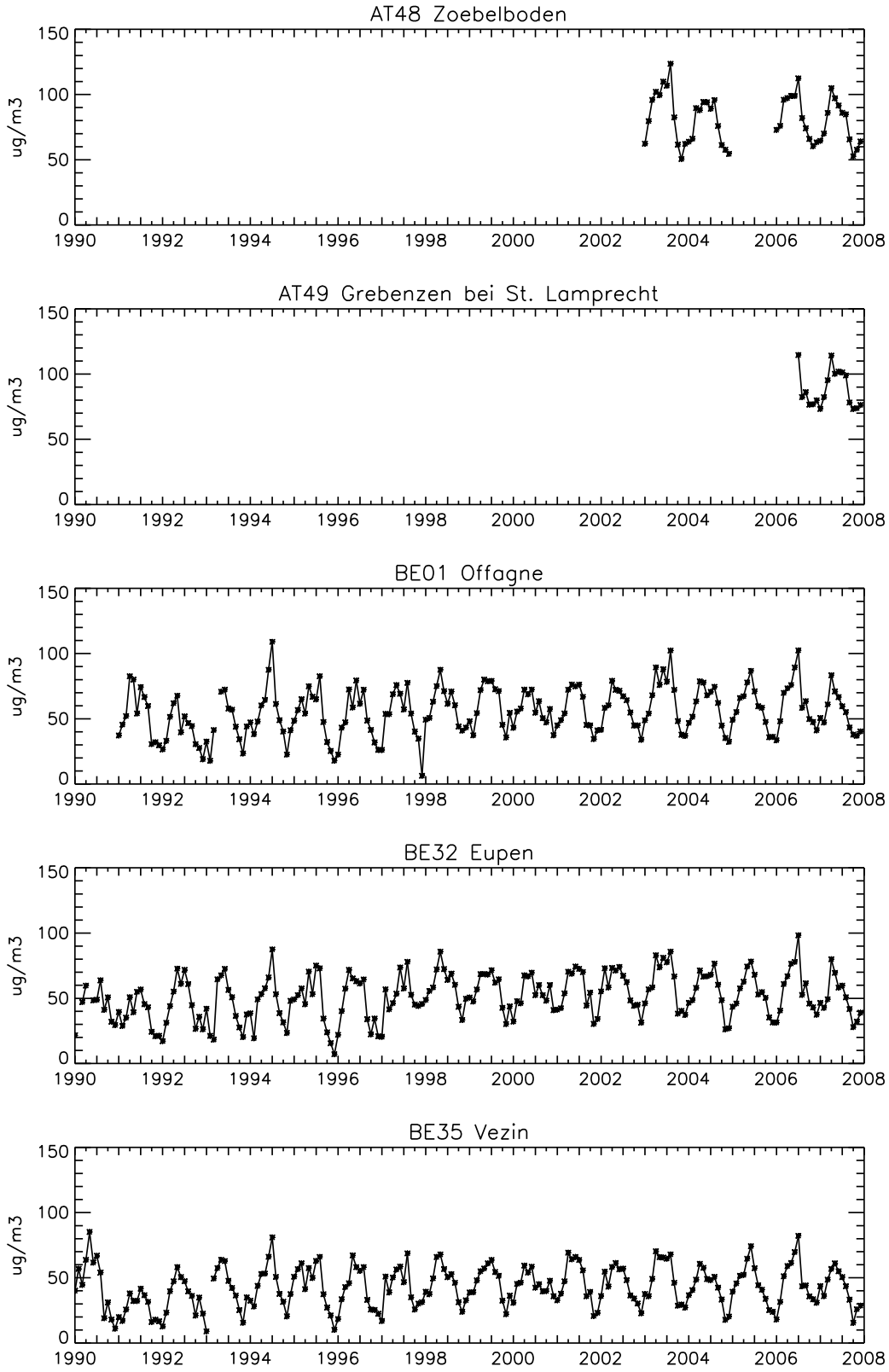
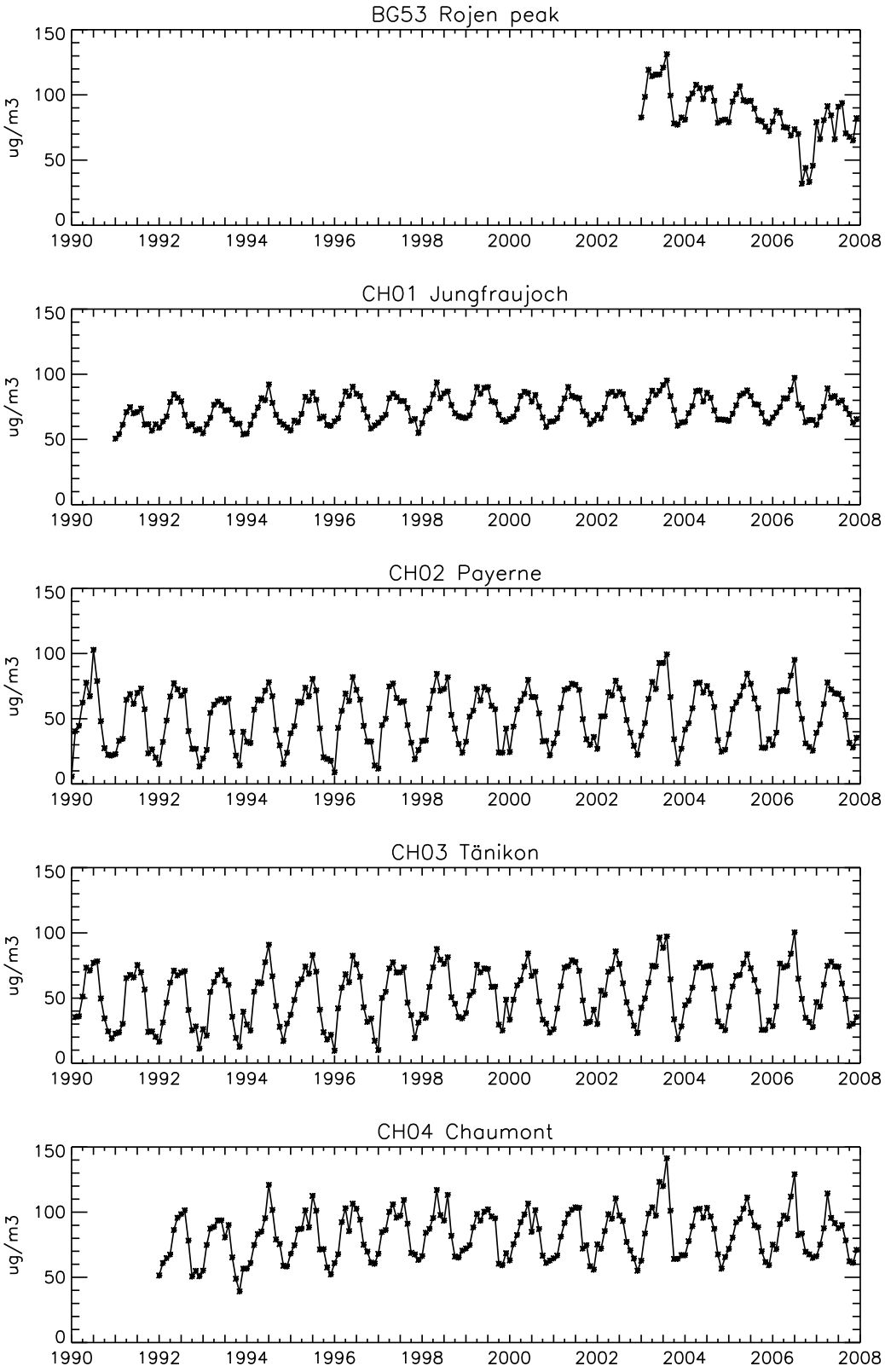


Figure 3.1, cont.



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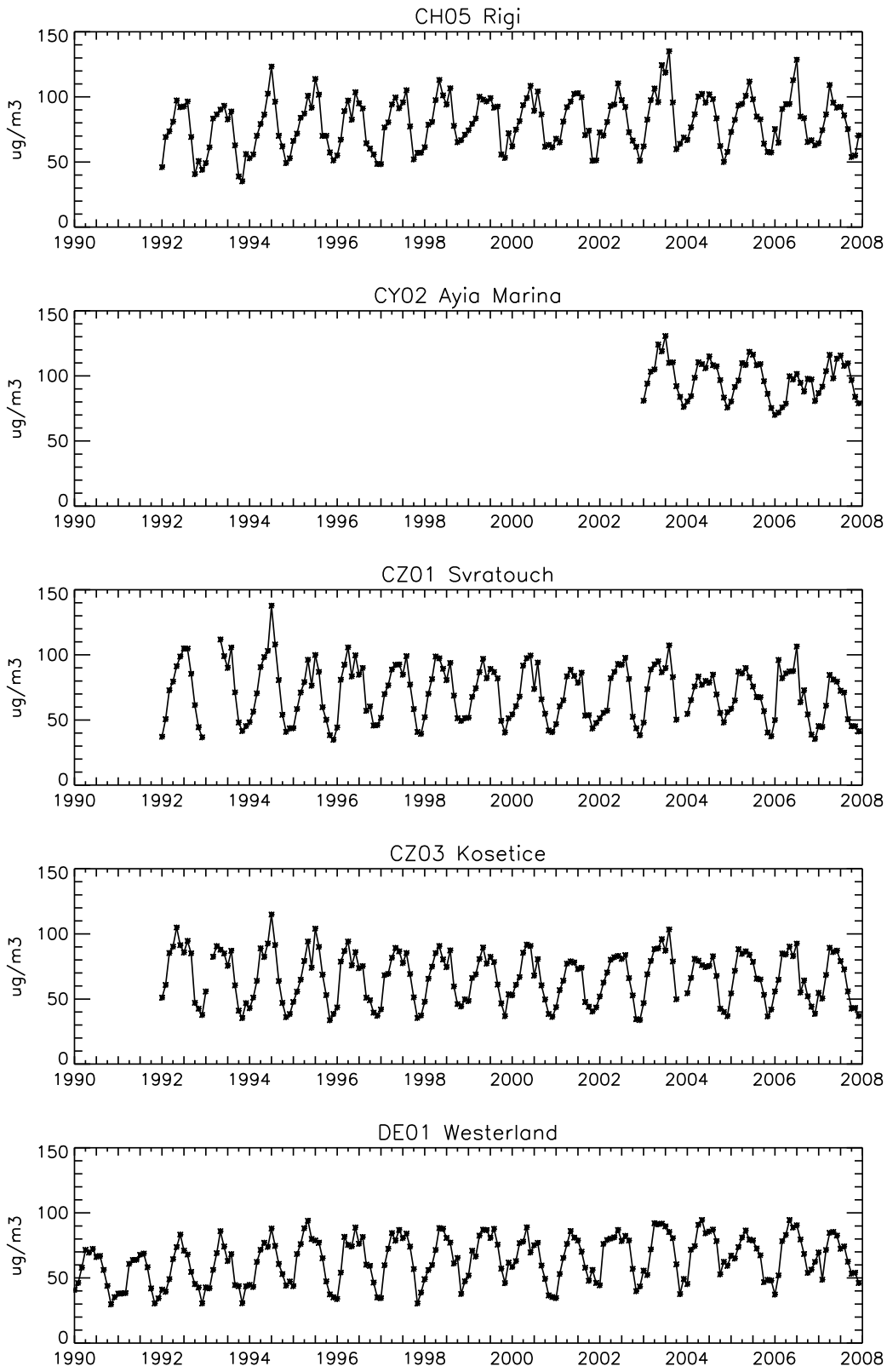

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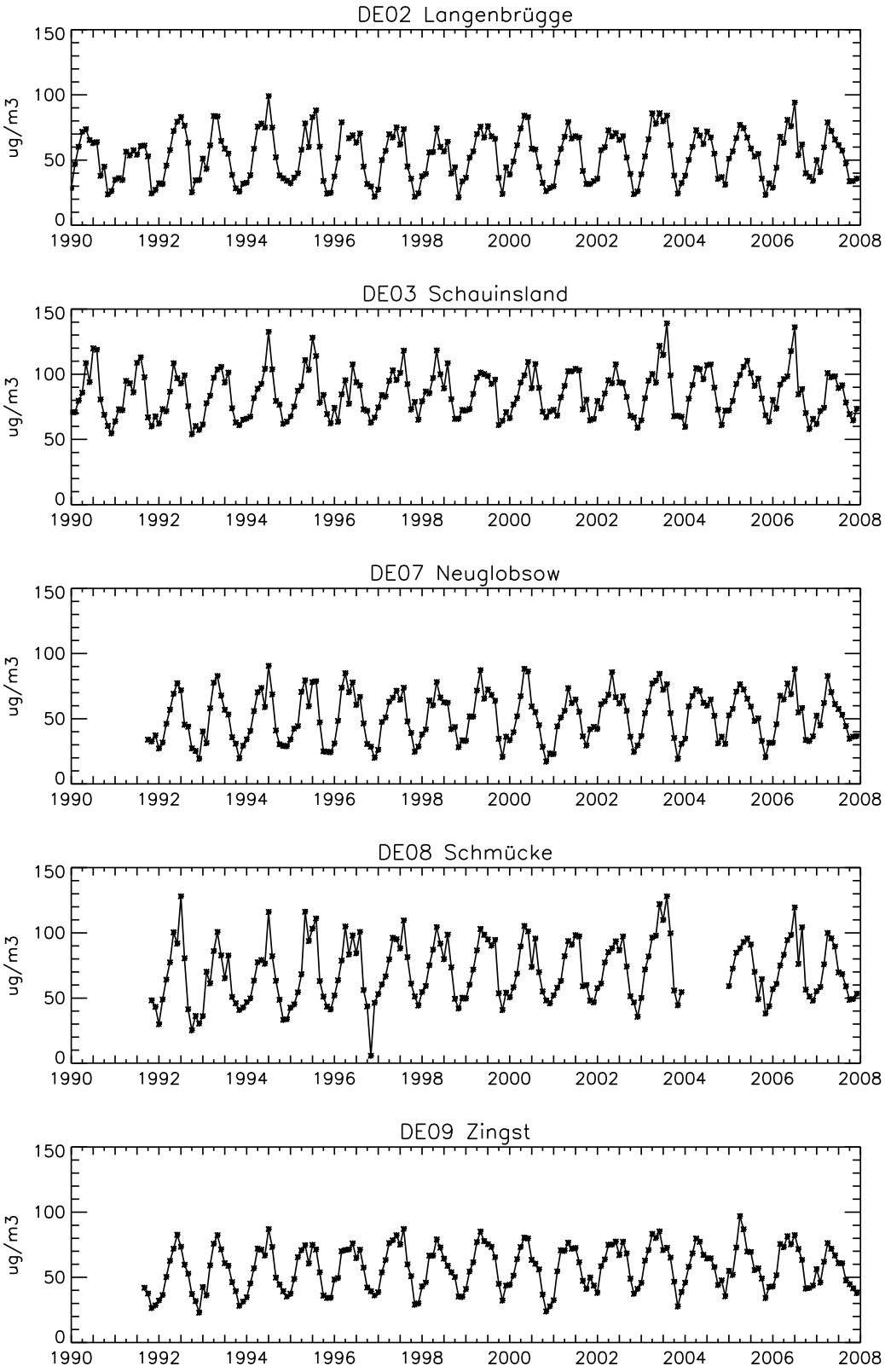

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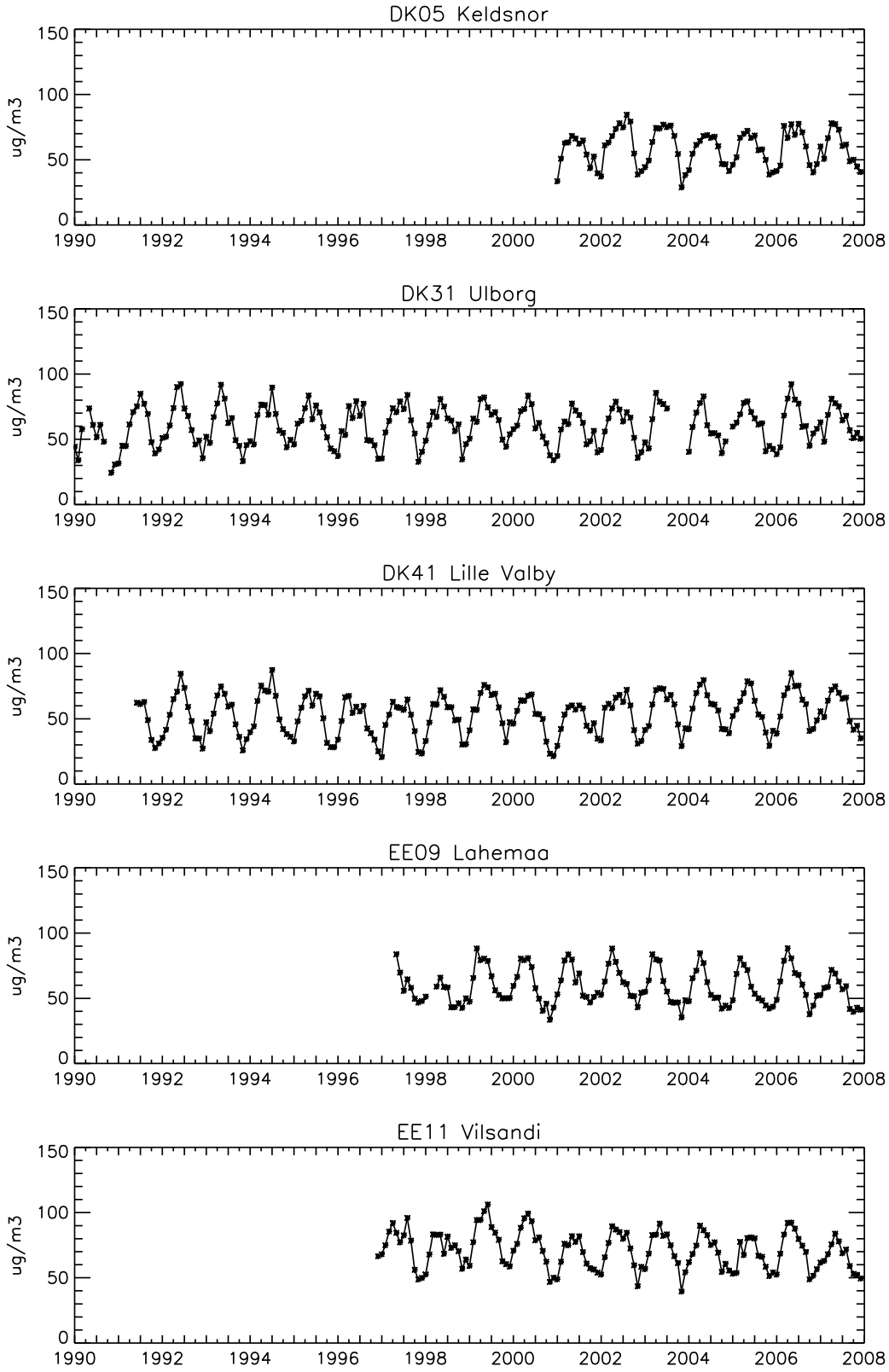

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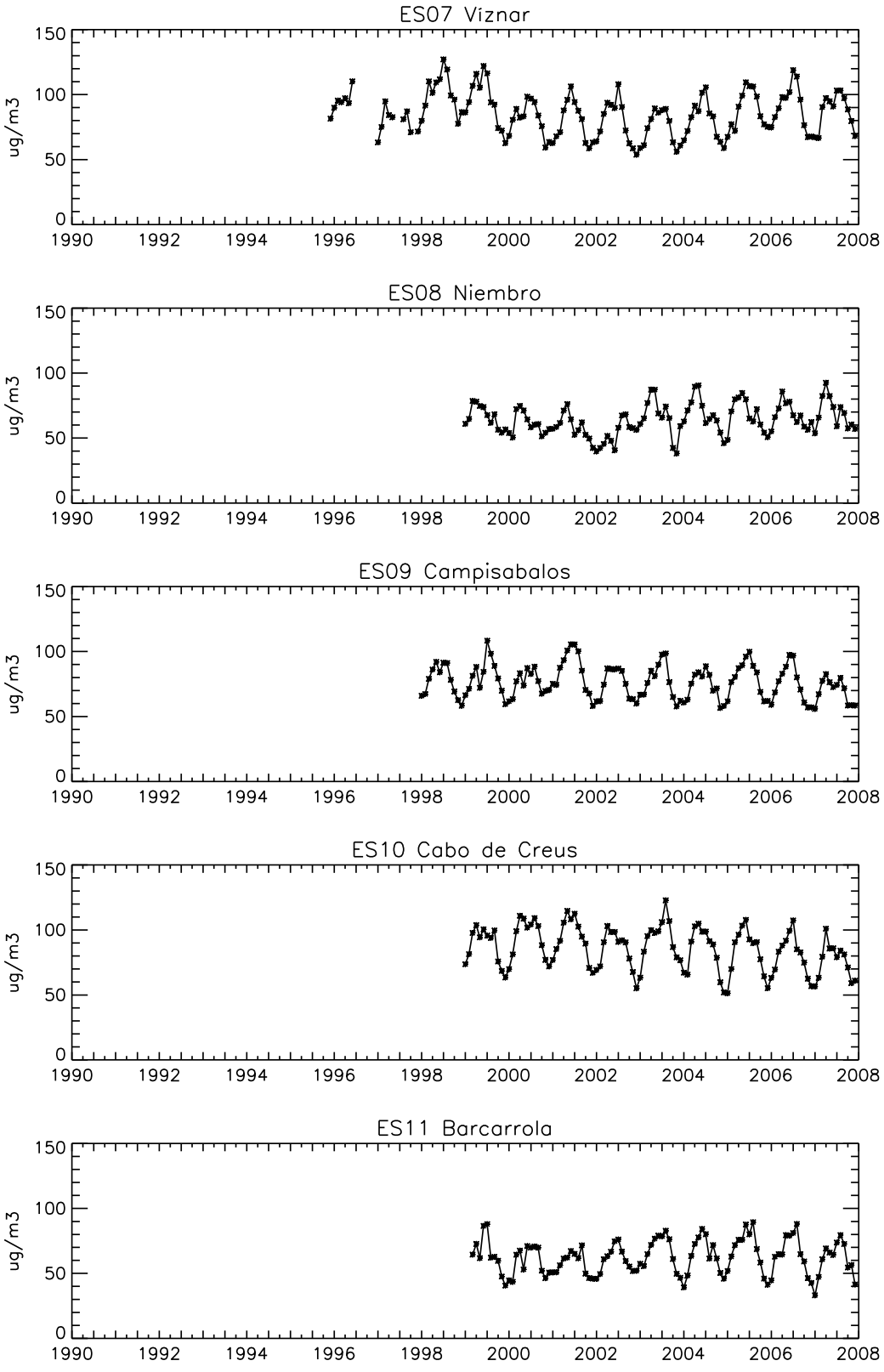

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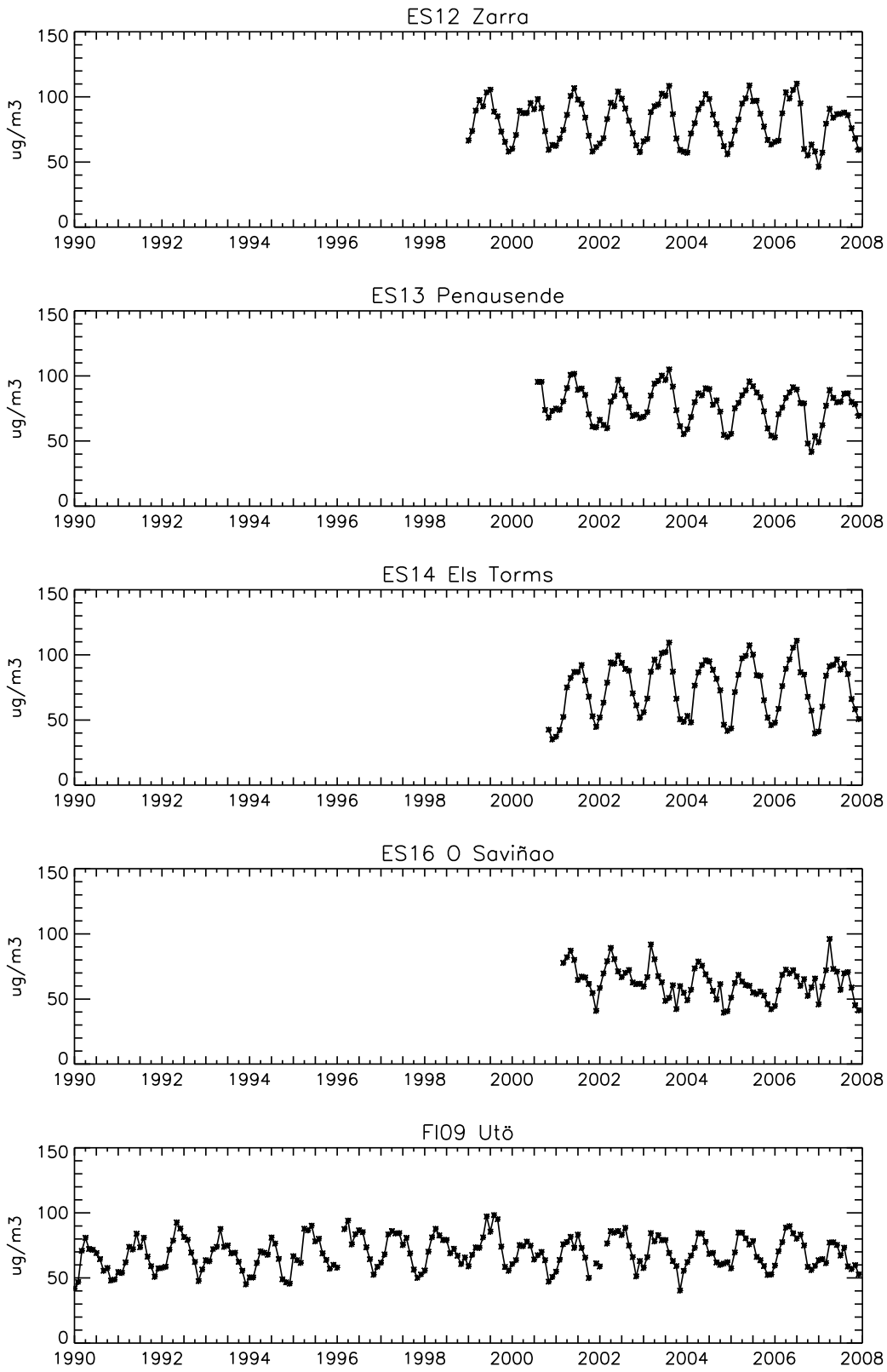

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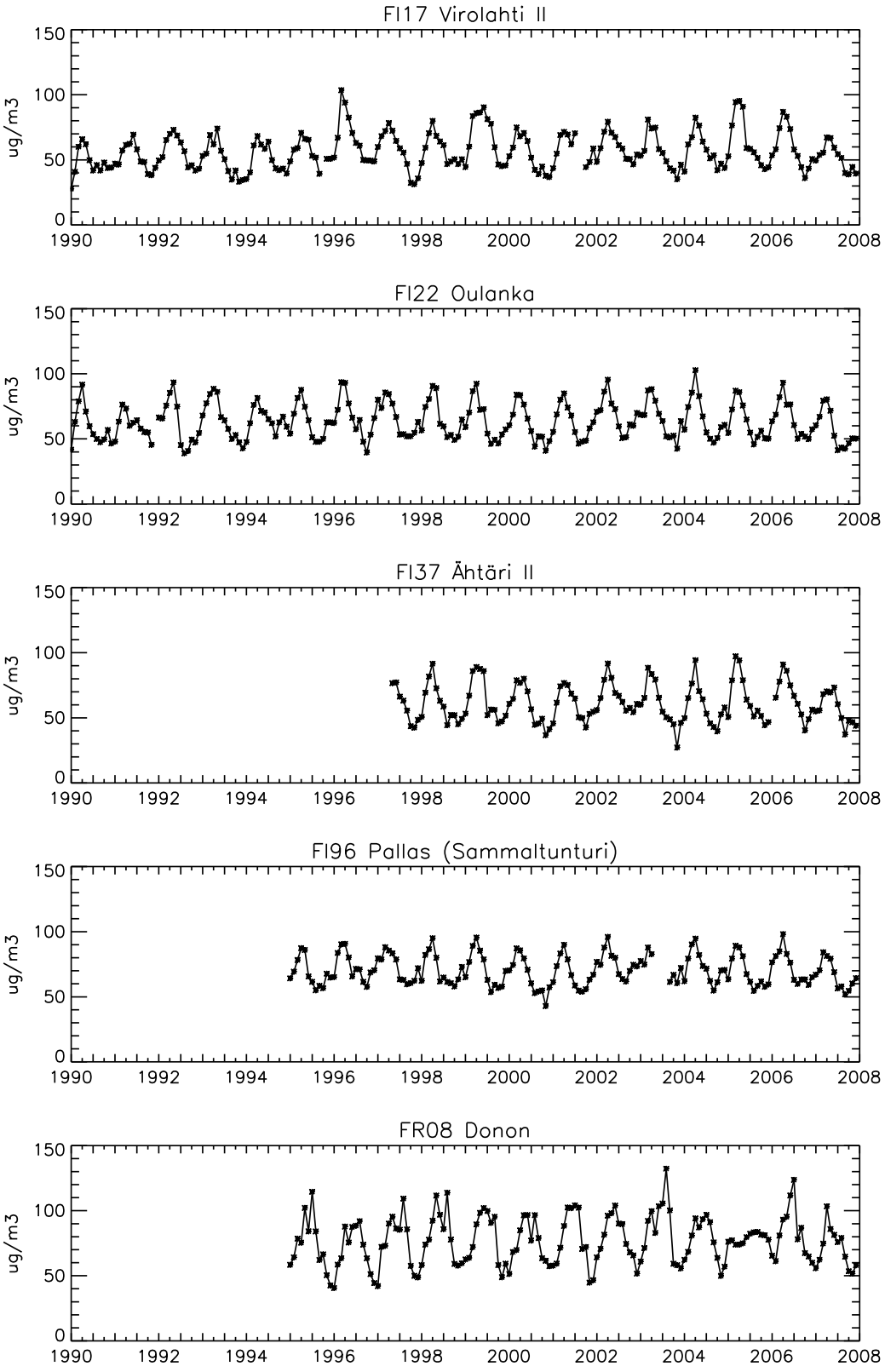

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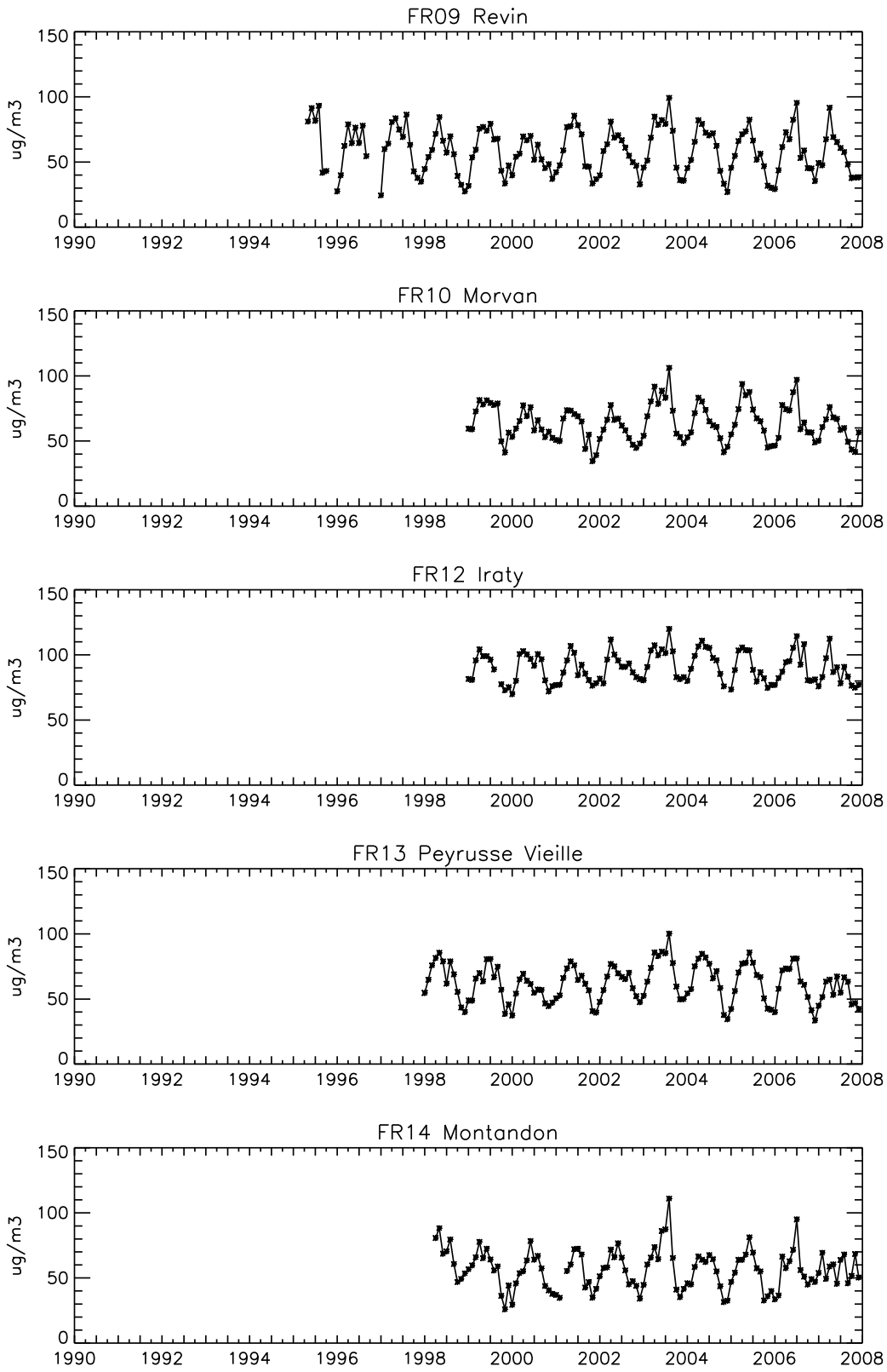

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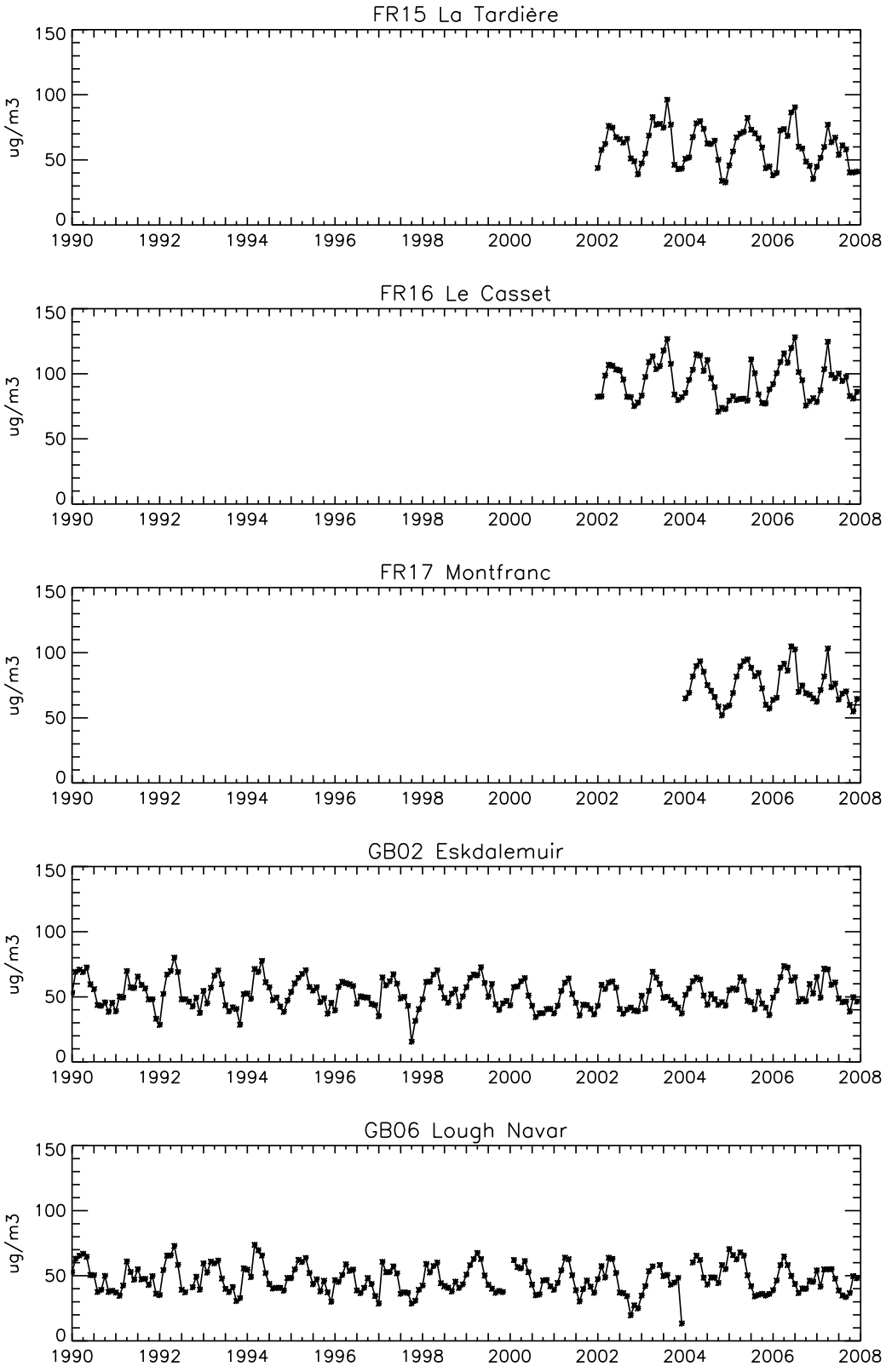

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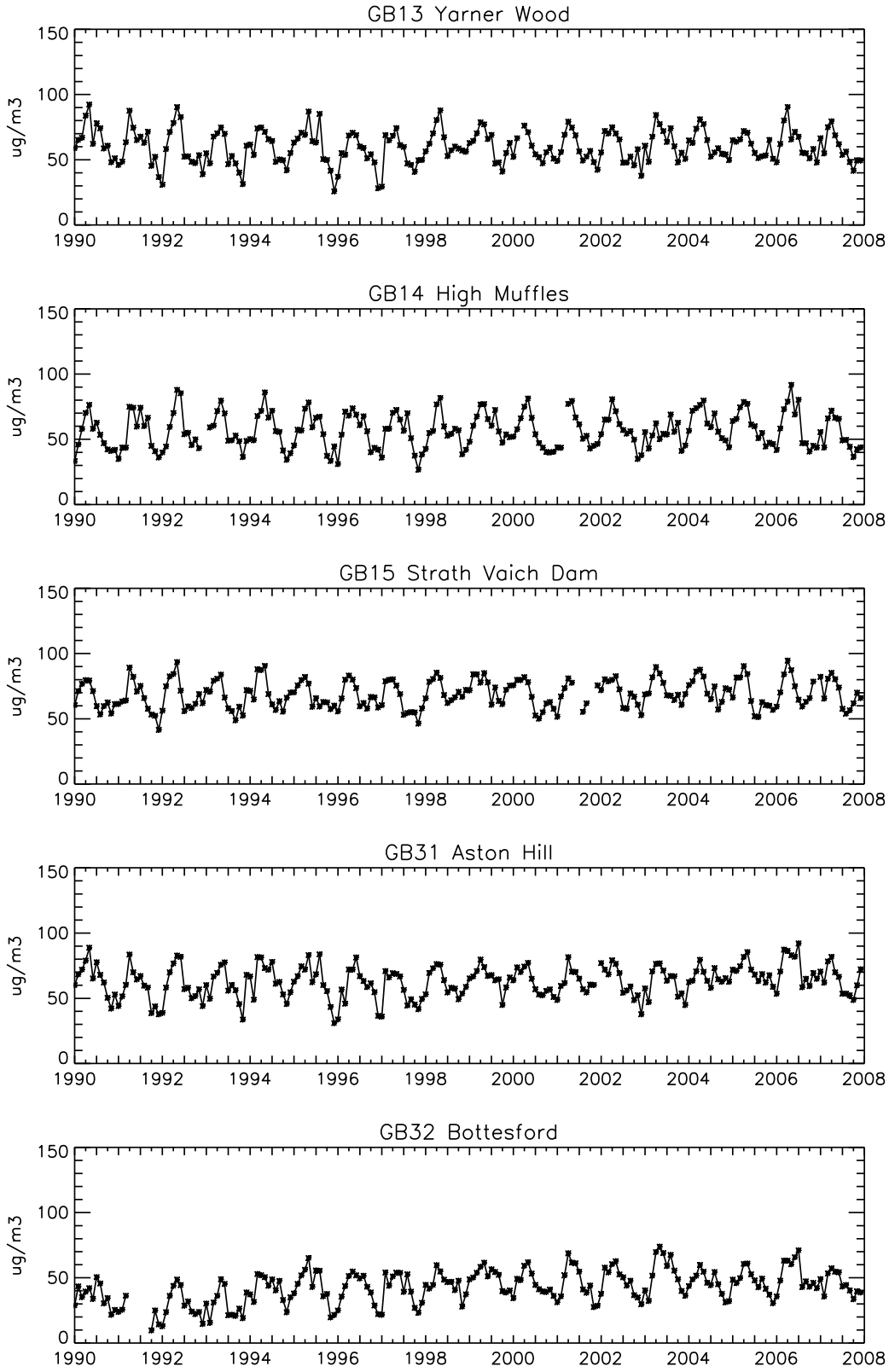

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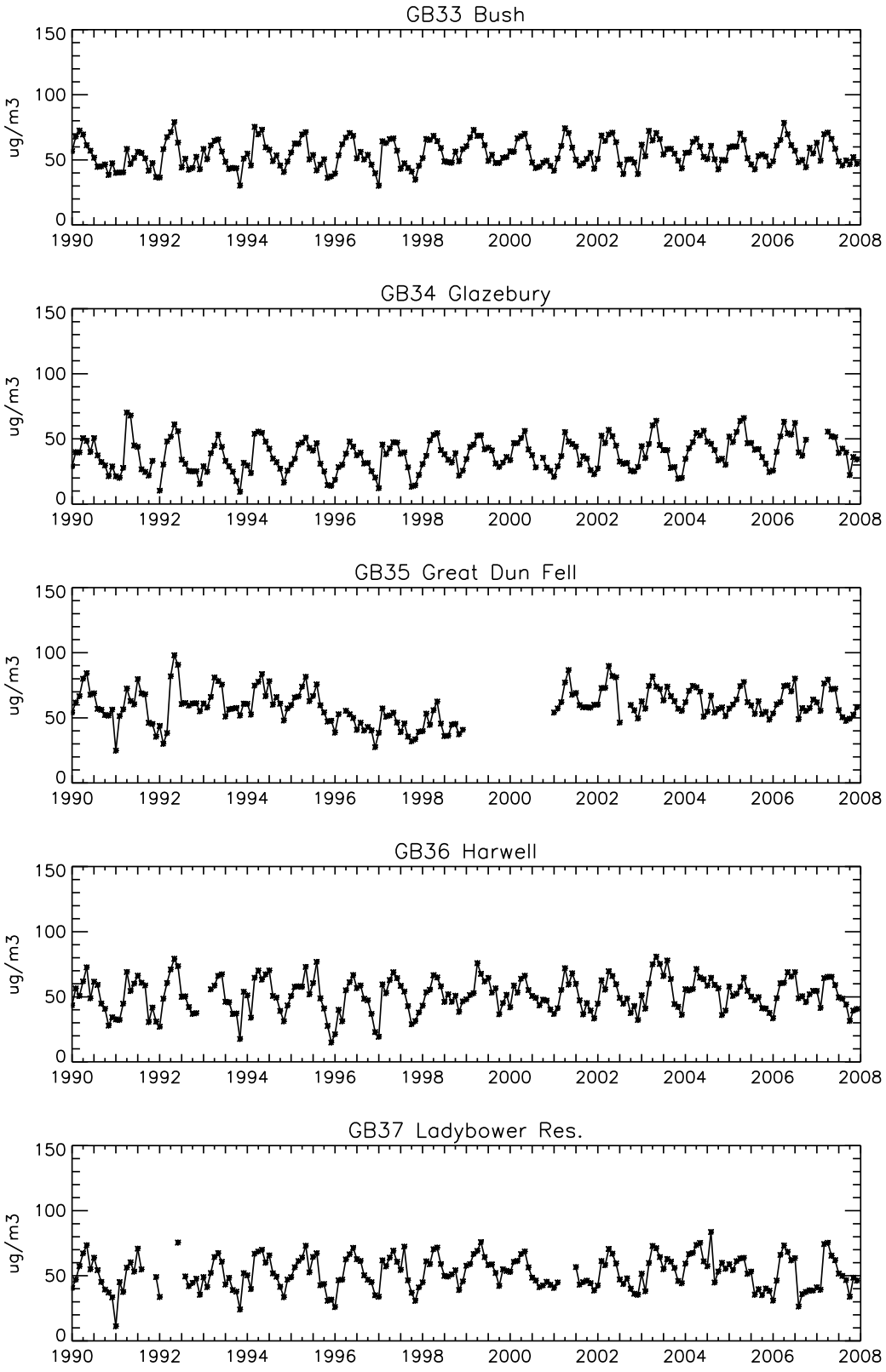

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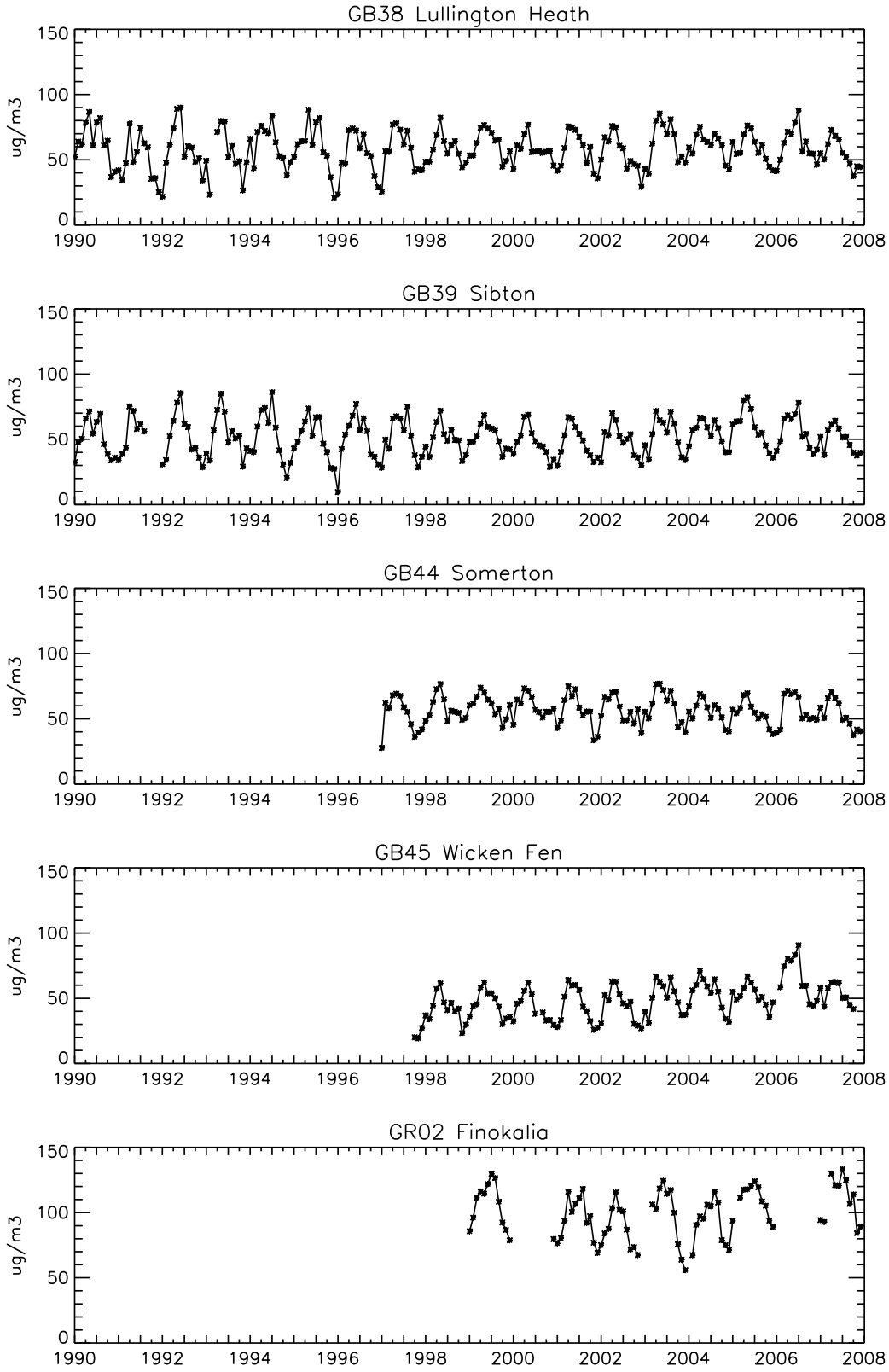

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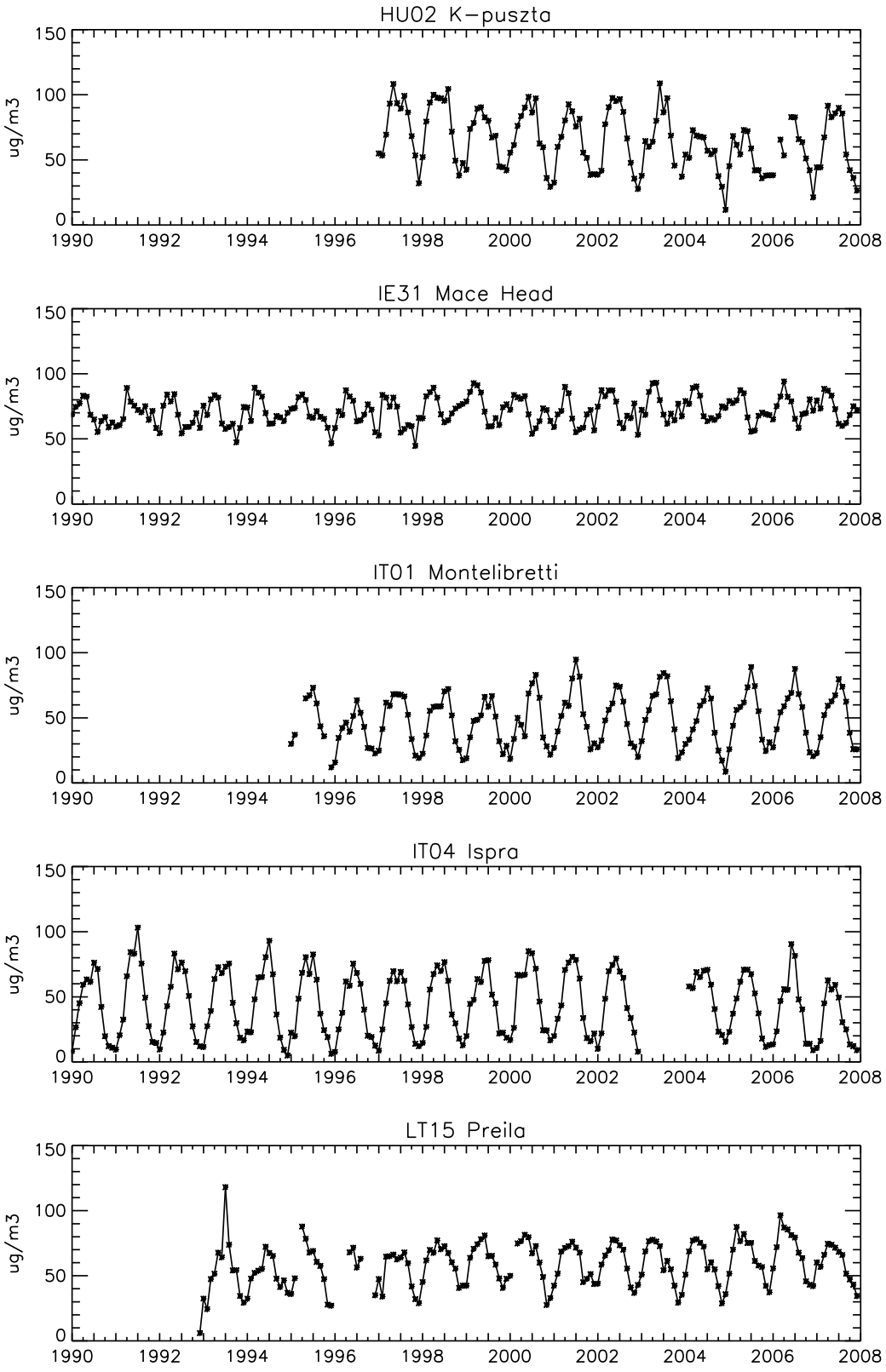

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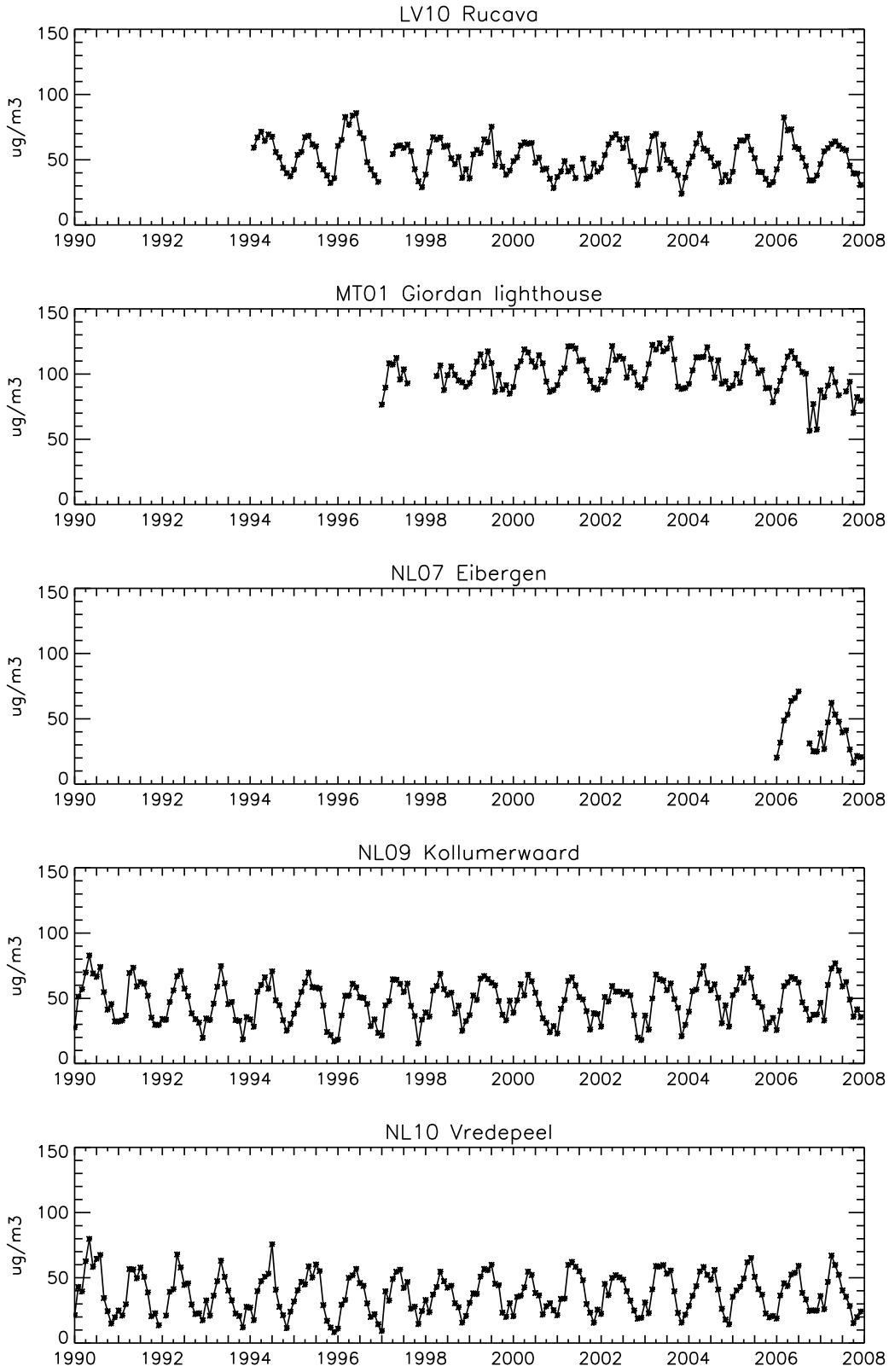

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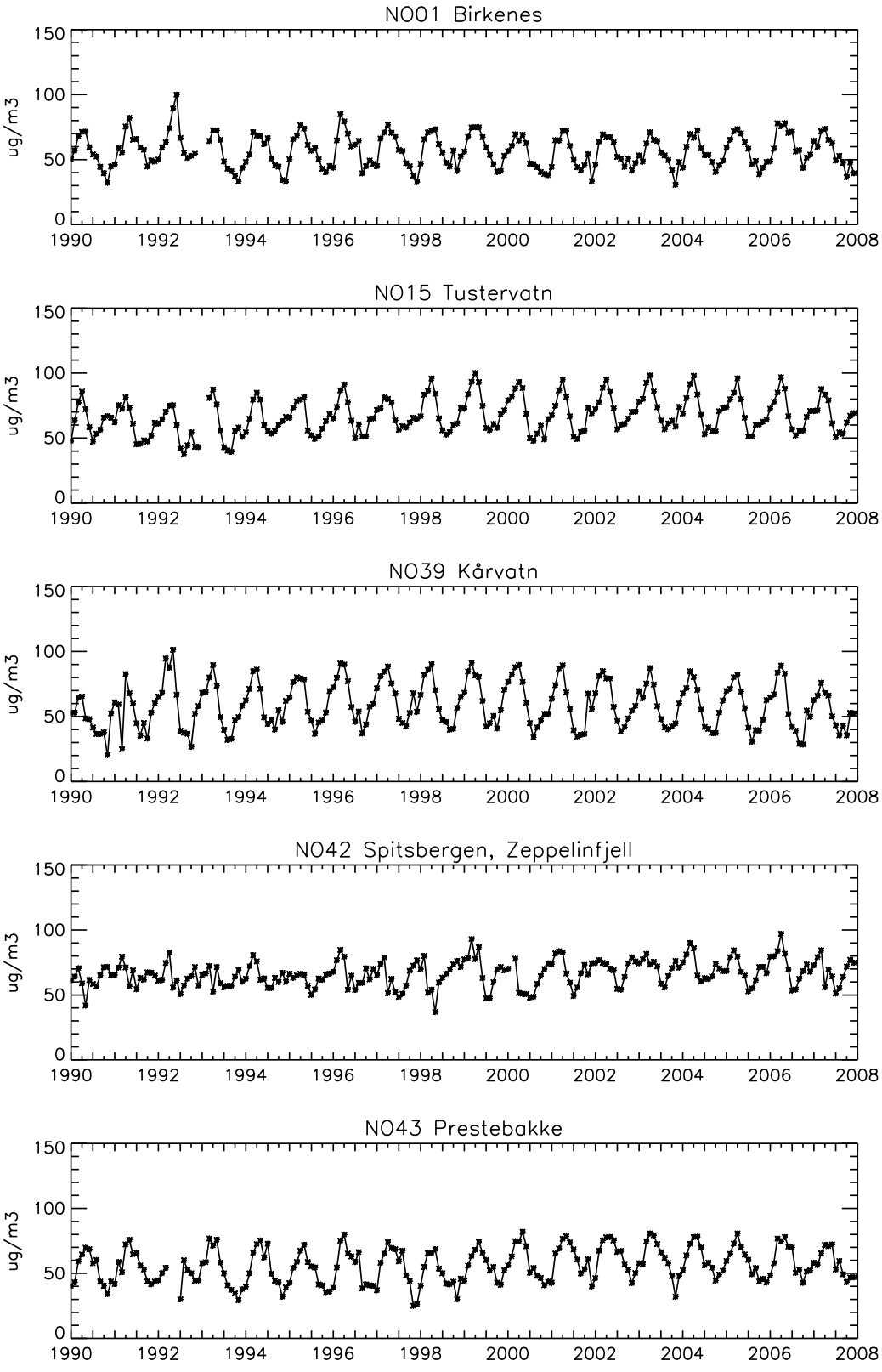

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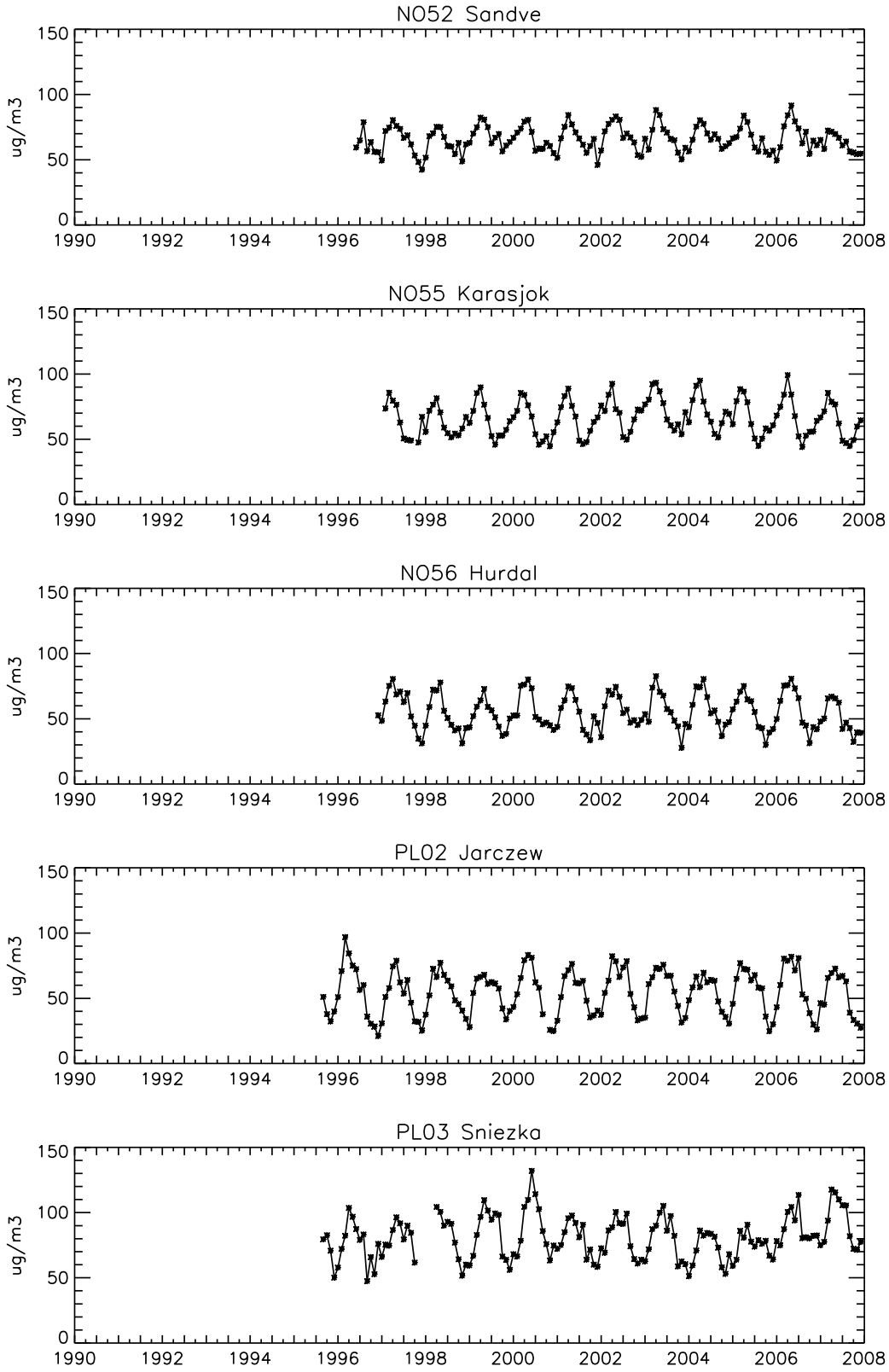

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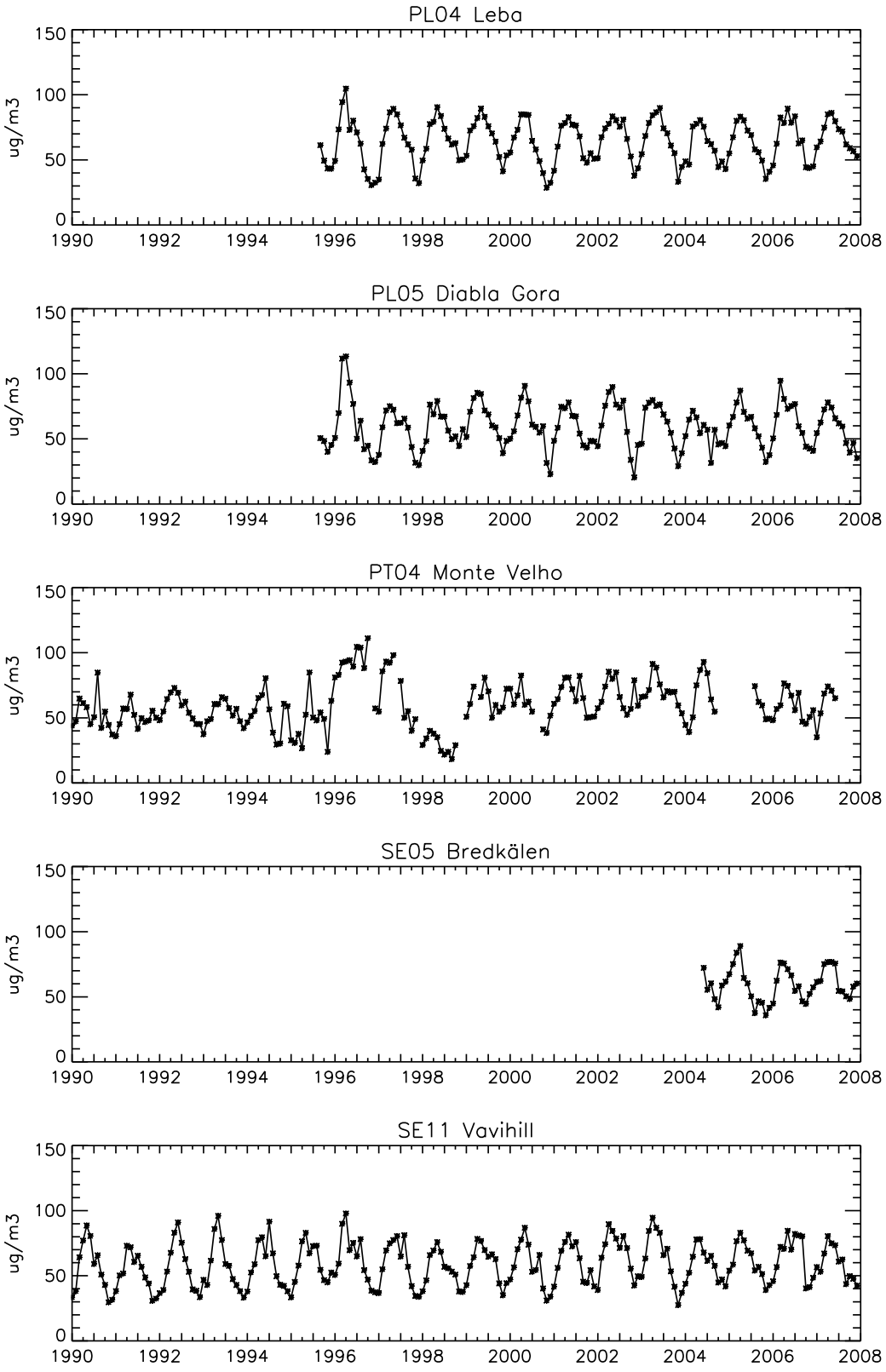

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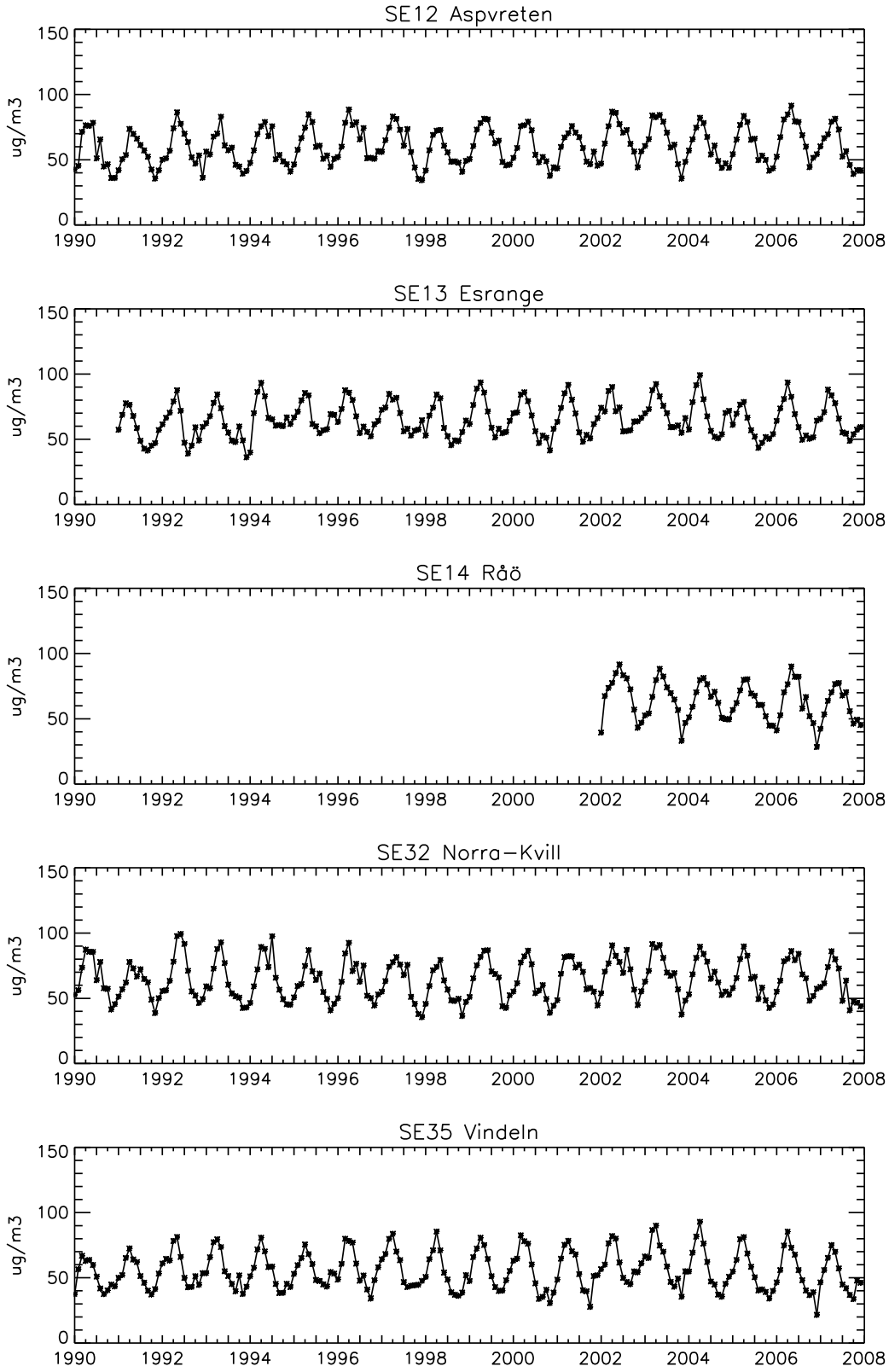

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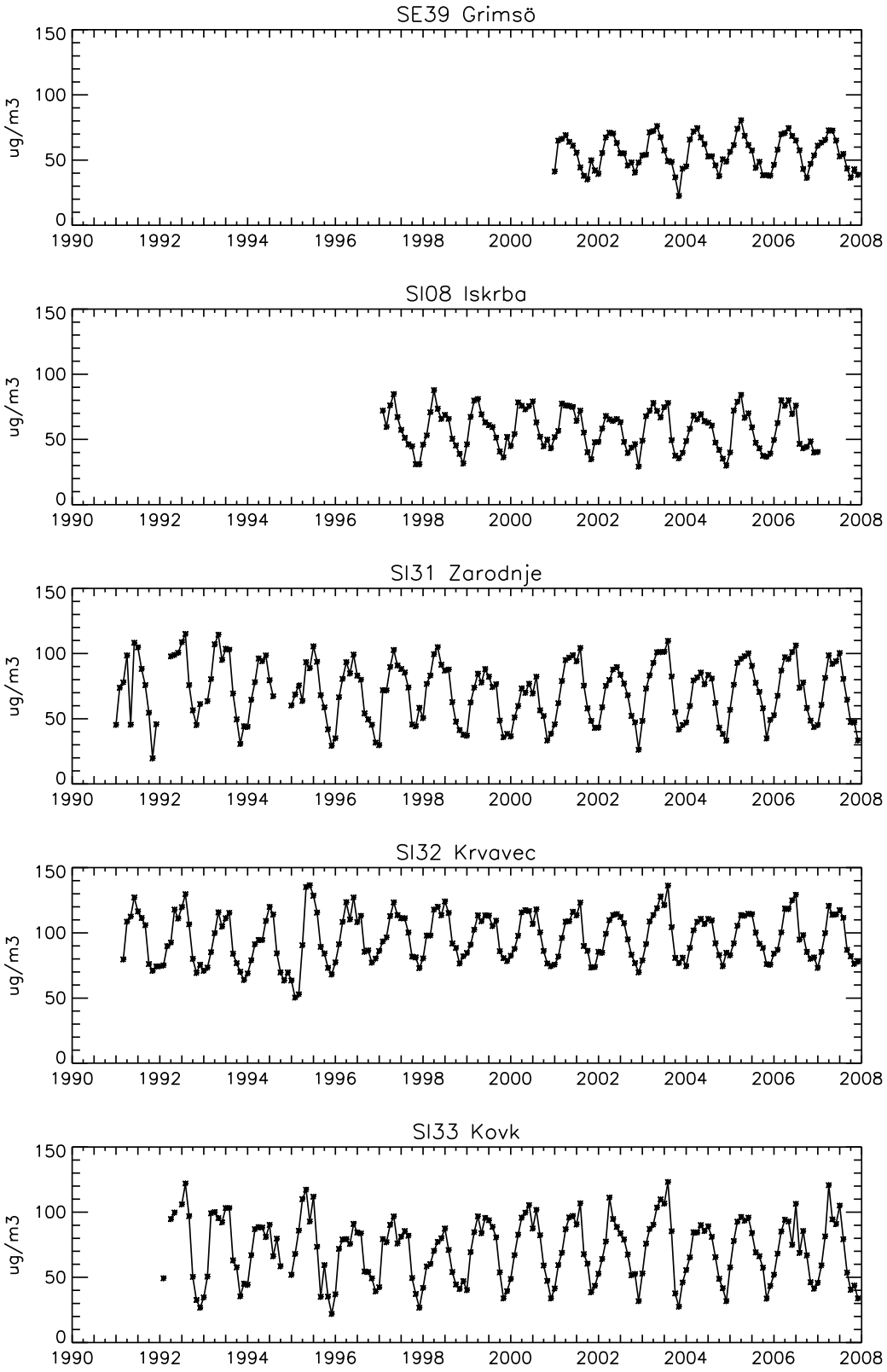

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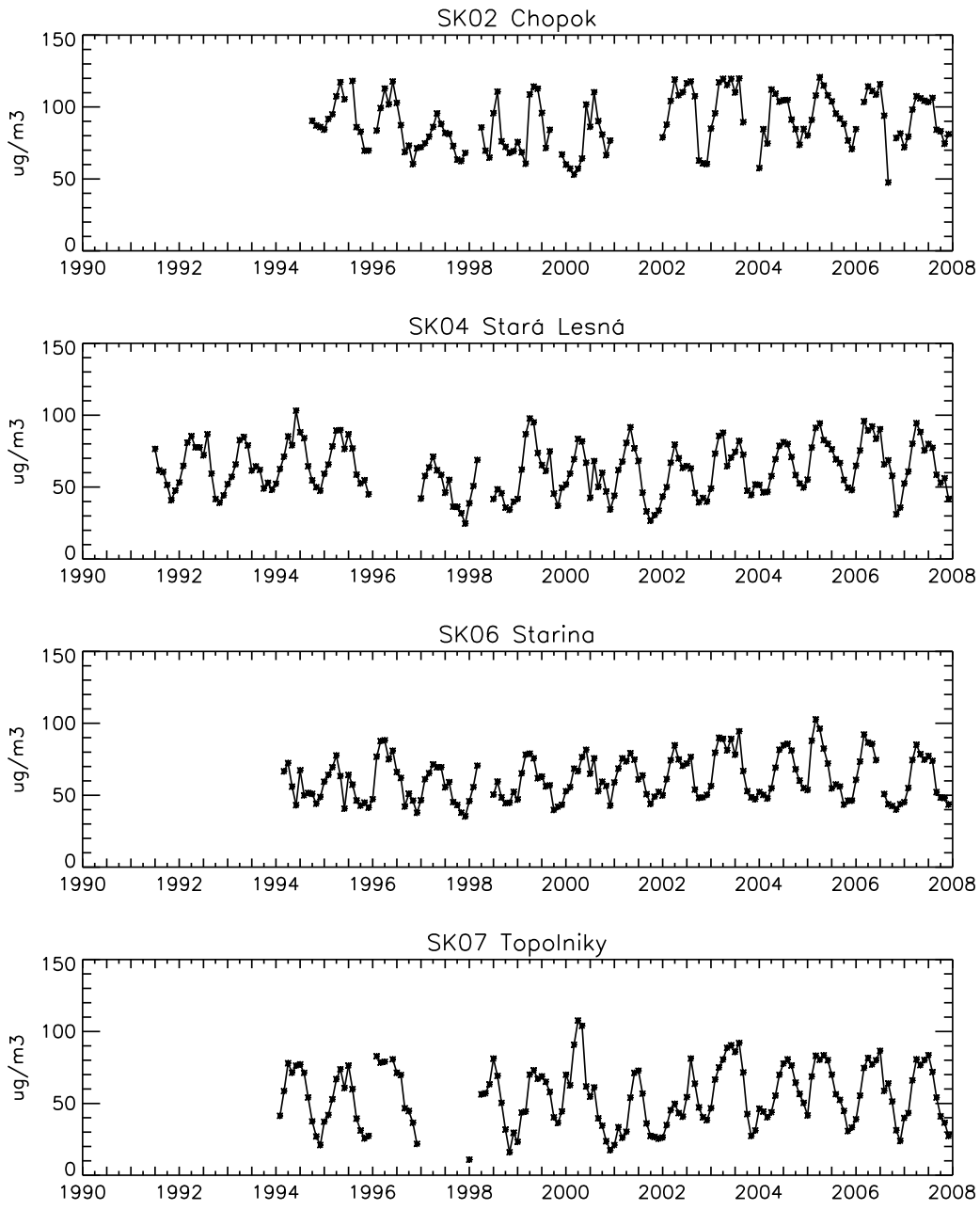


Figure 3.1, cont.

Annex 4

Diurnal variation, April–September 2007

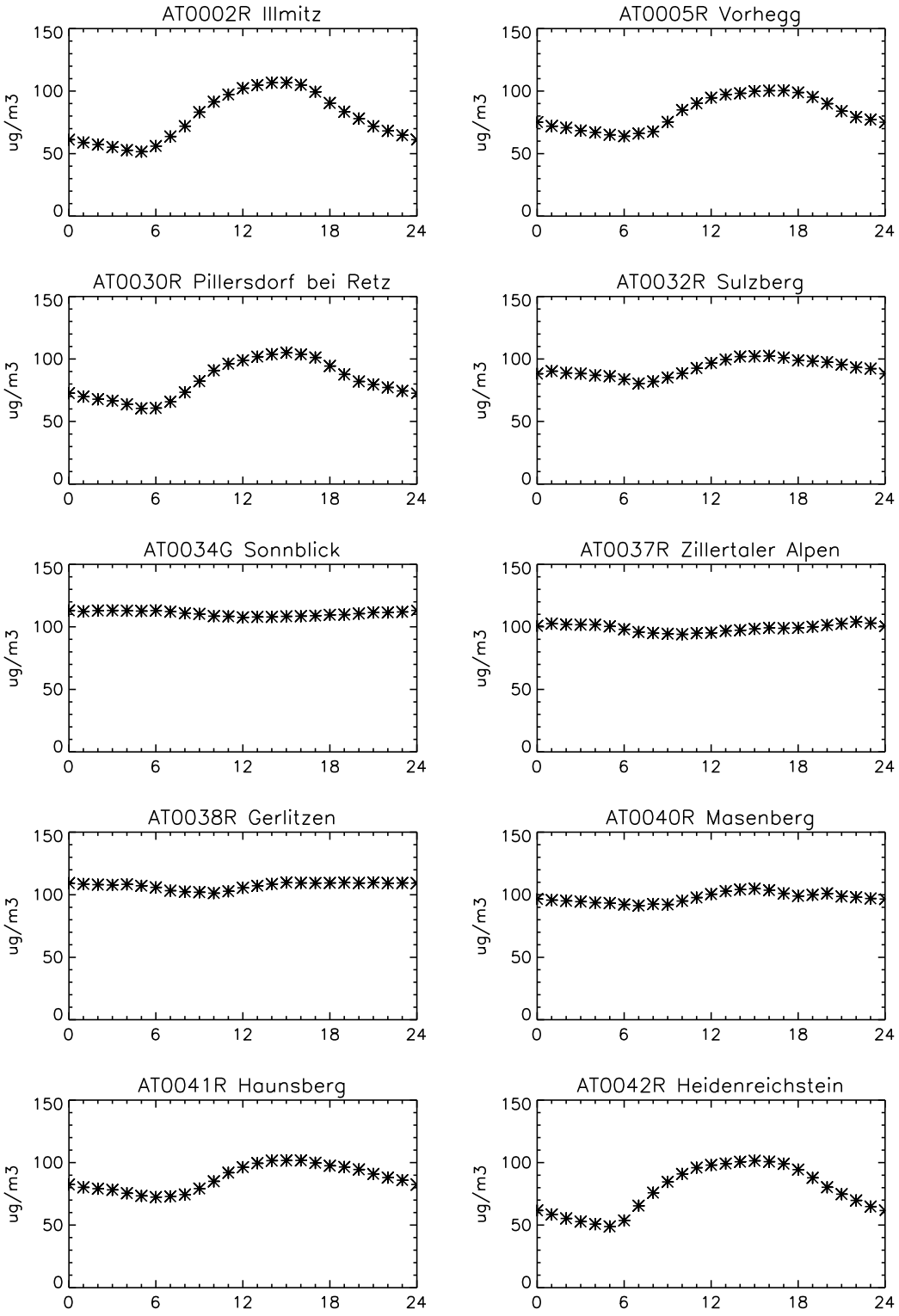
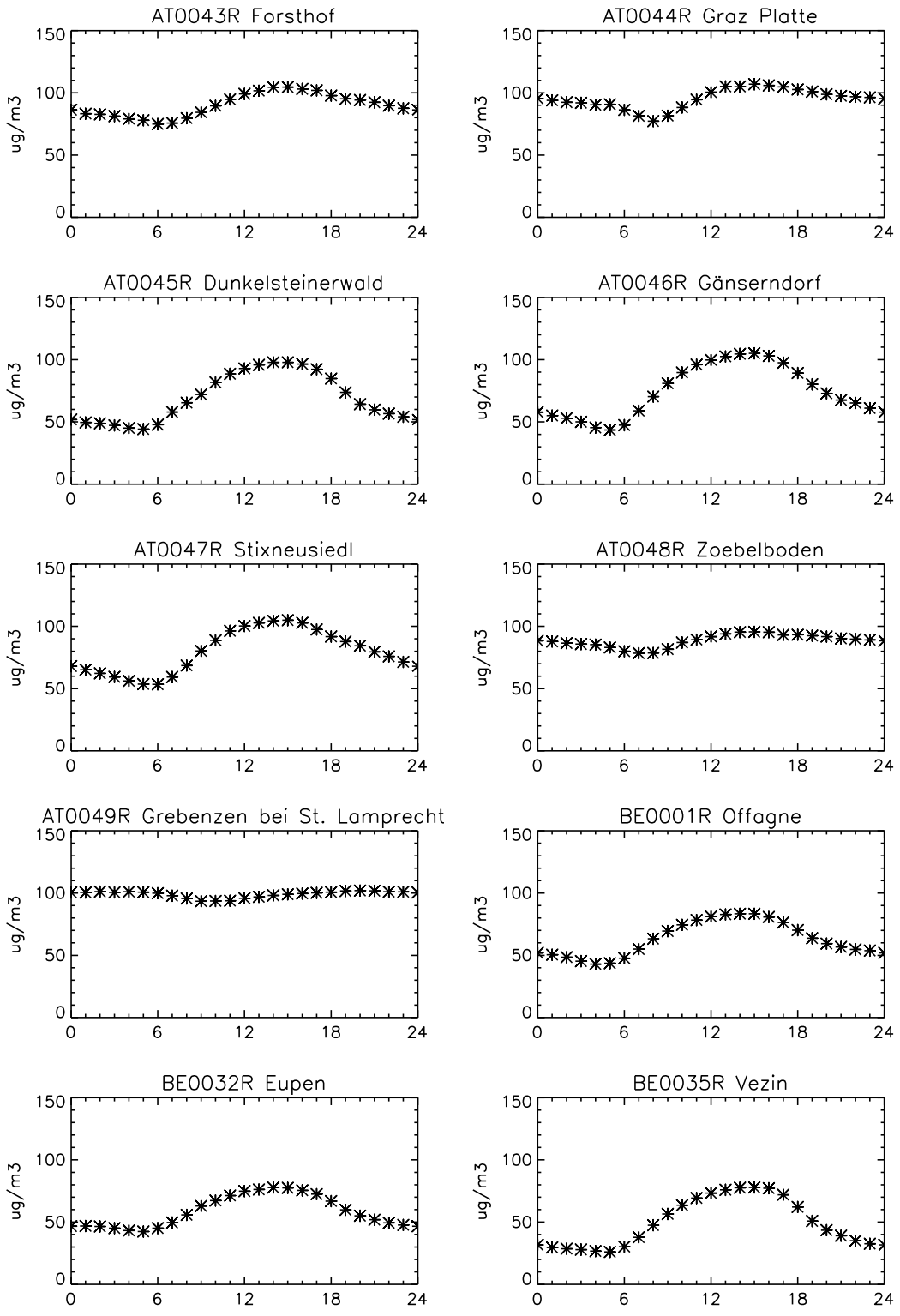


Figure 4.1: Diurnal variation, April–September 2007.



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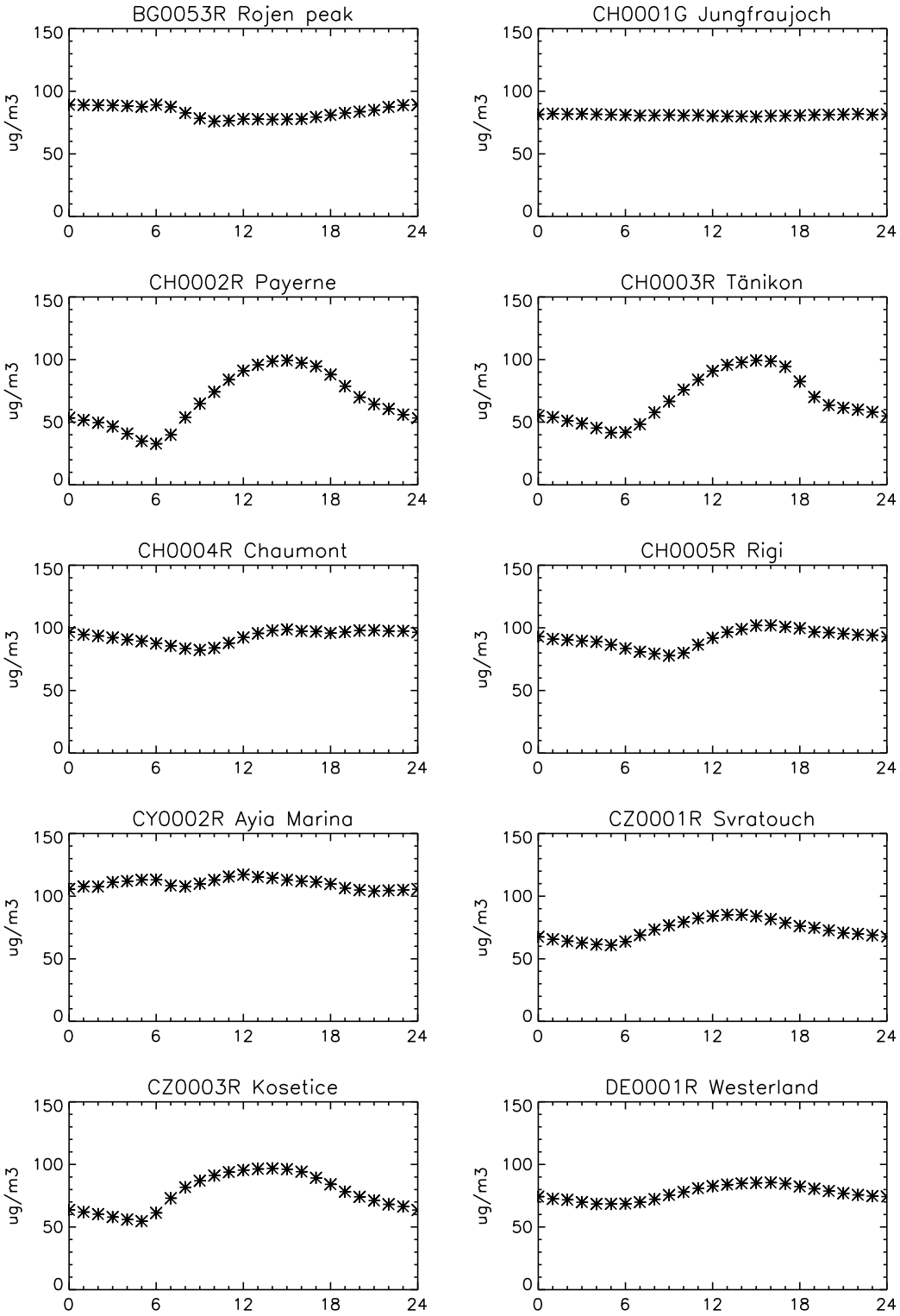

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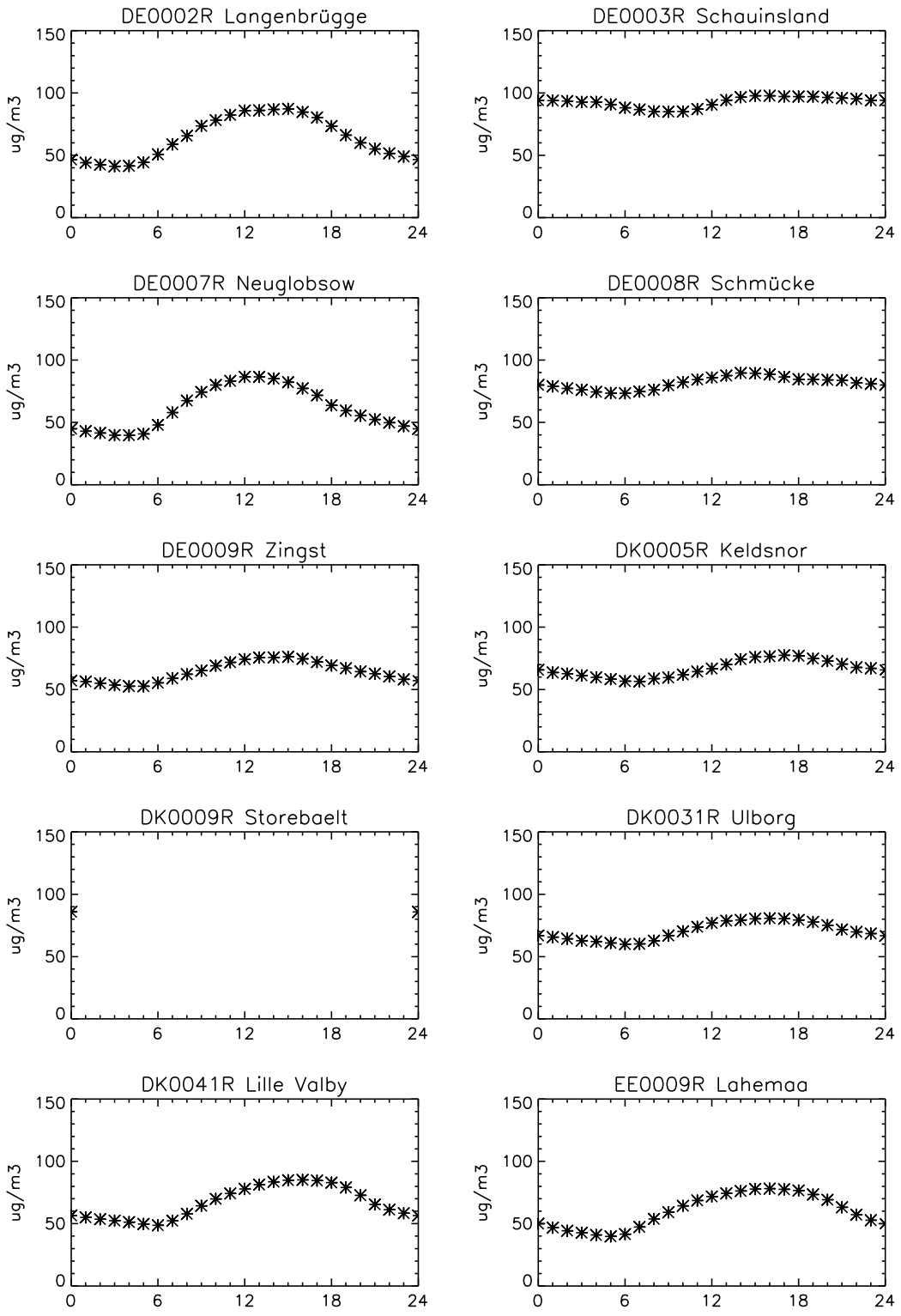

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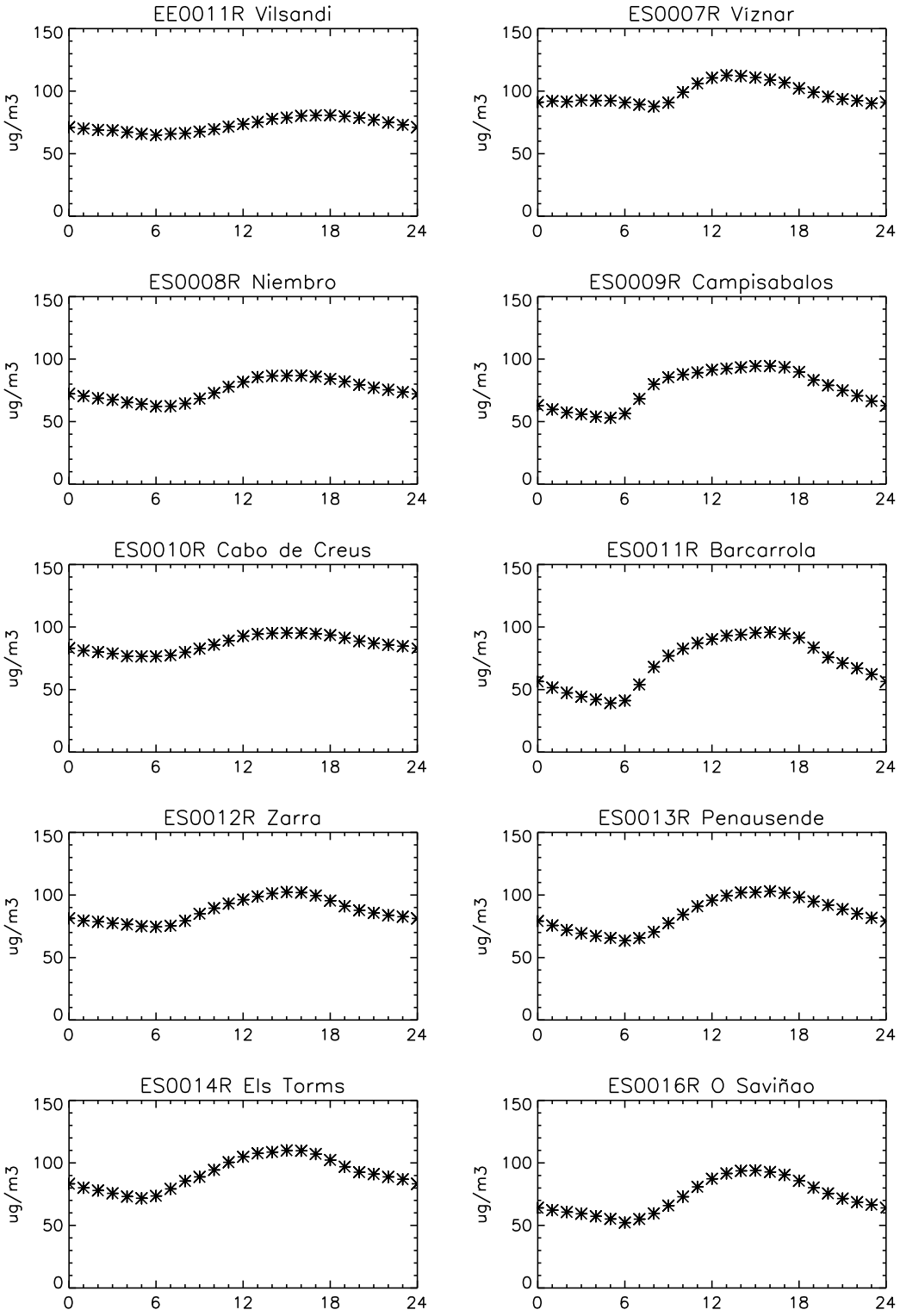

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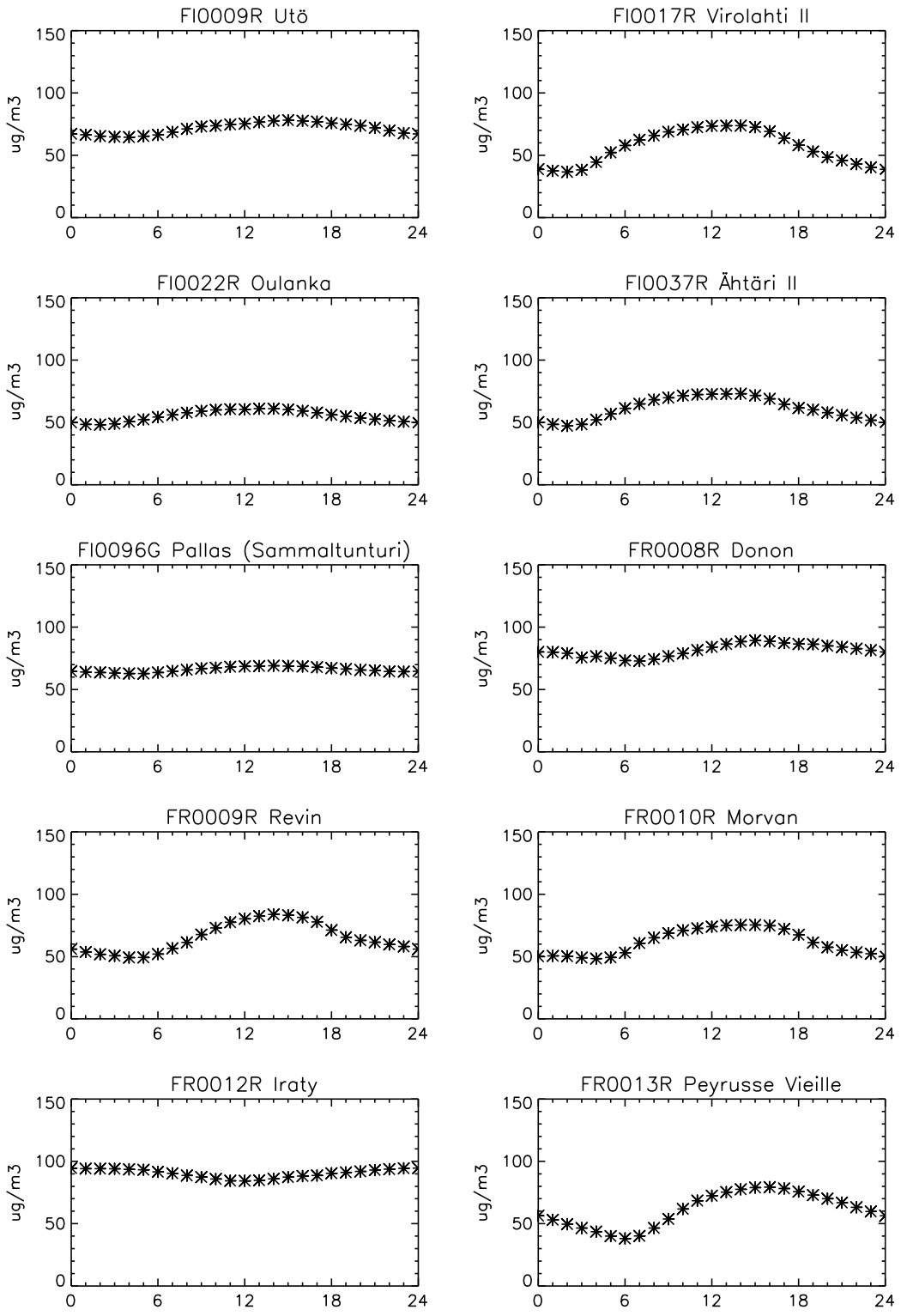

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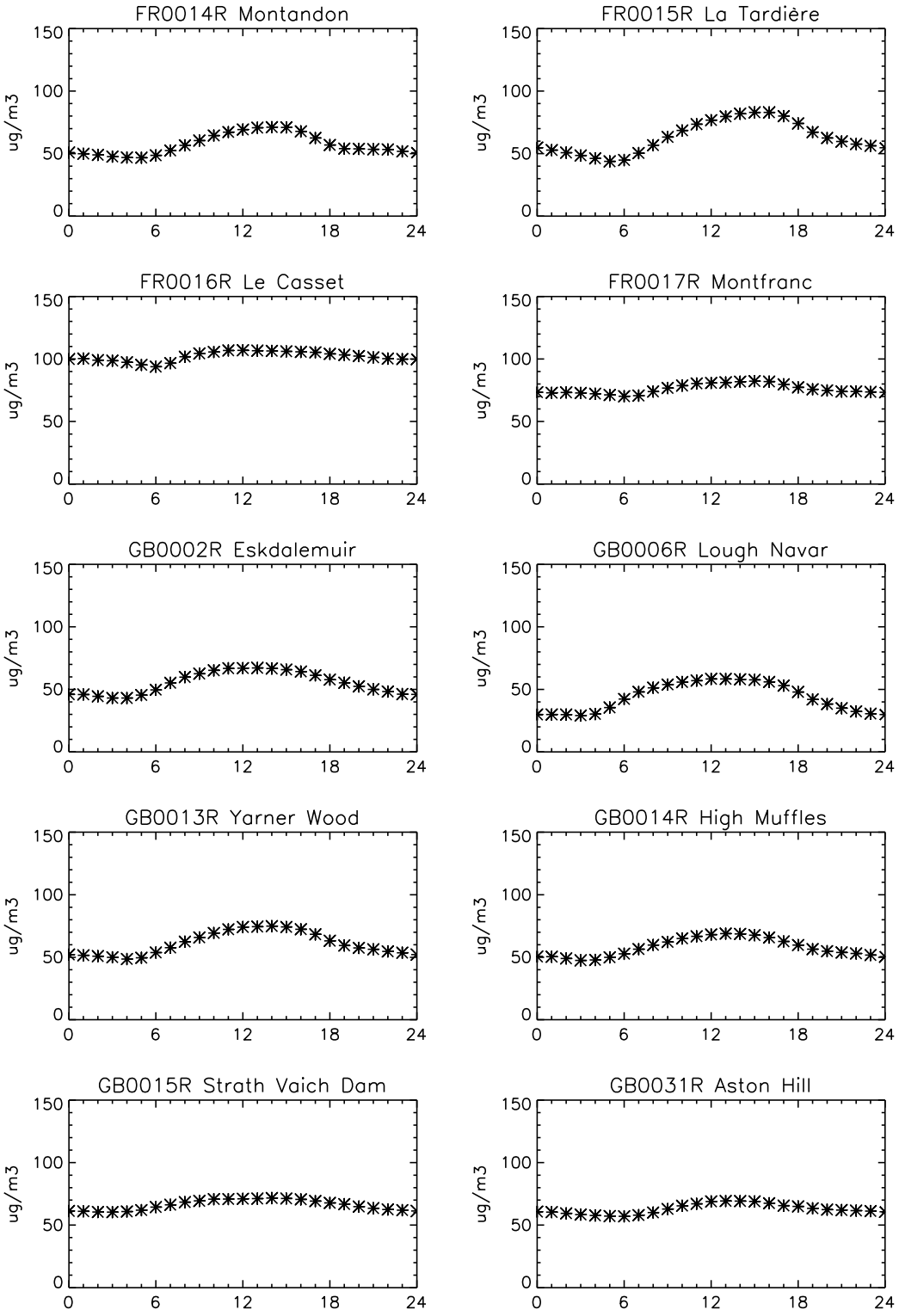

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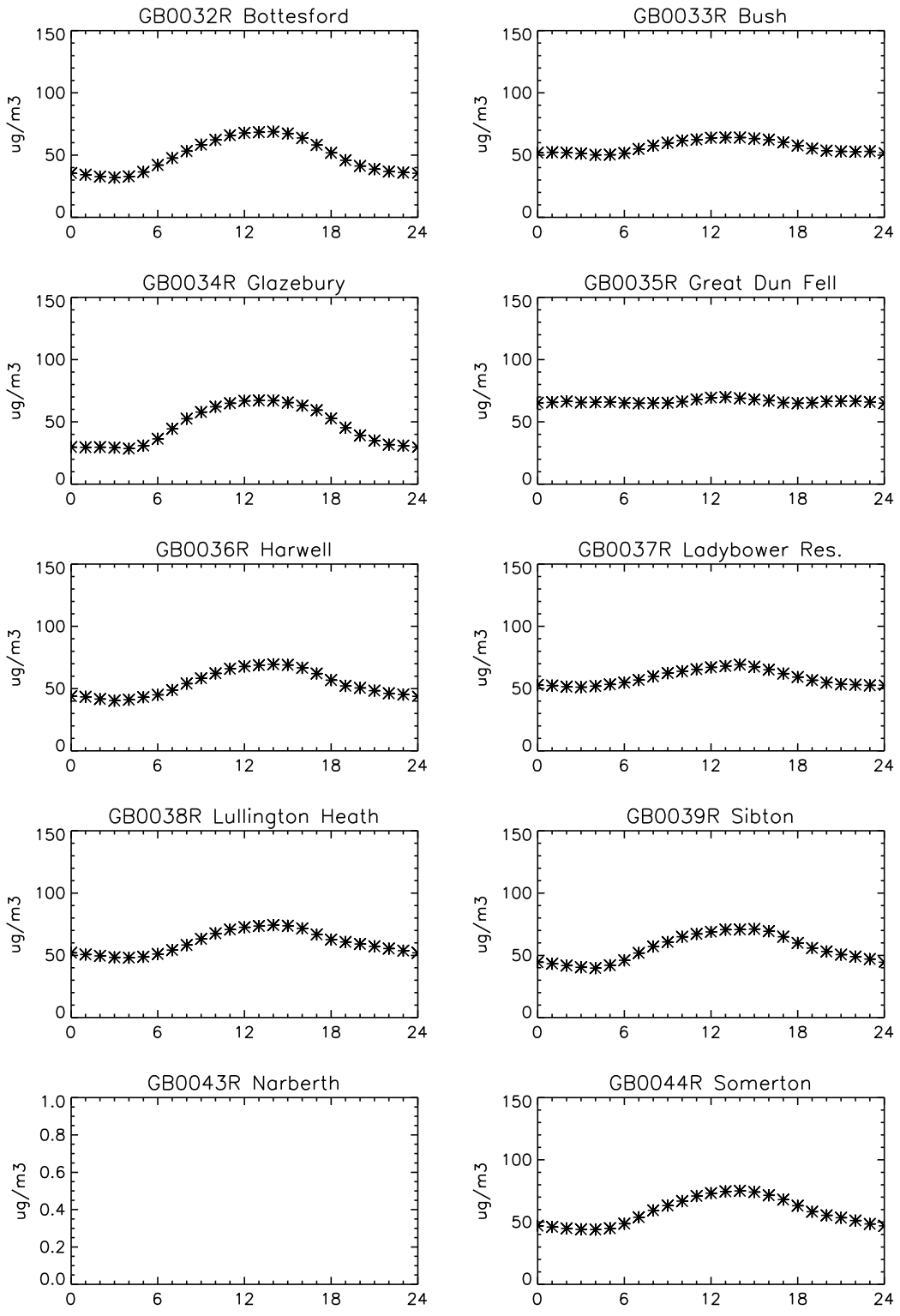

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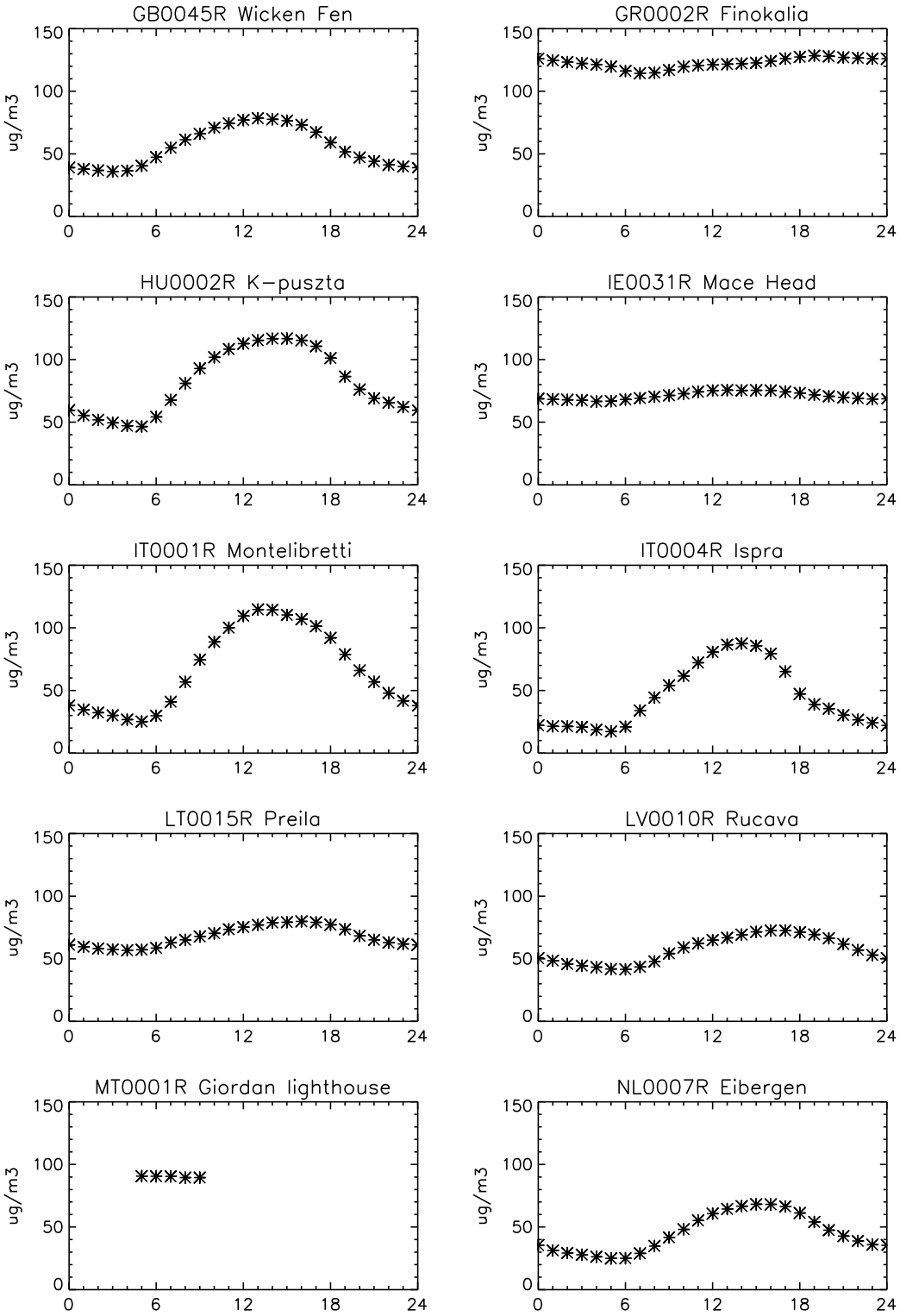

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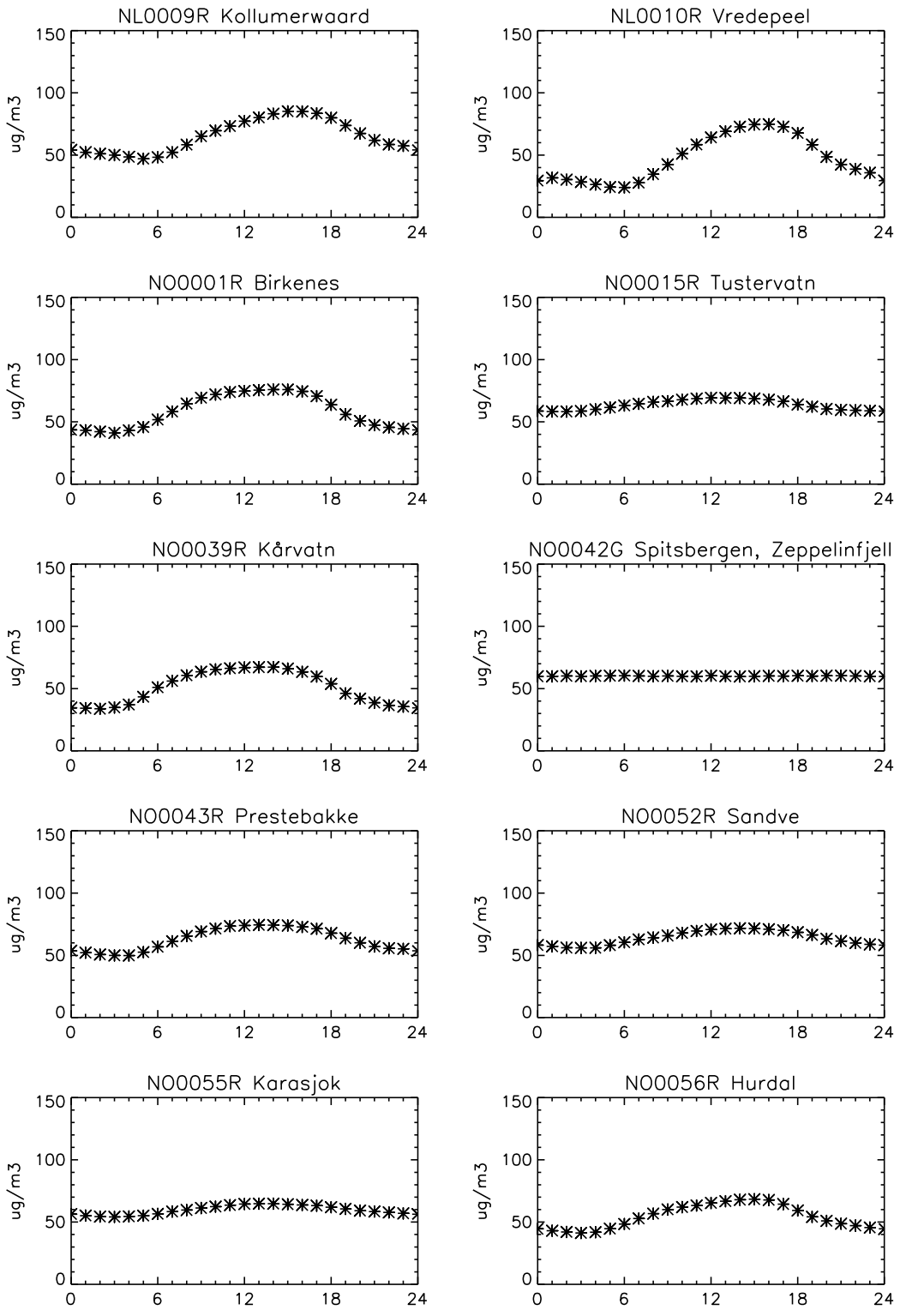

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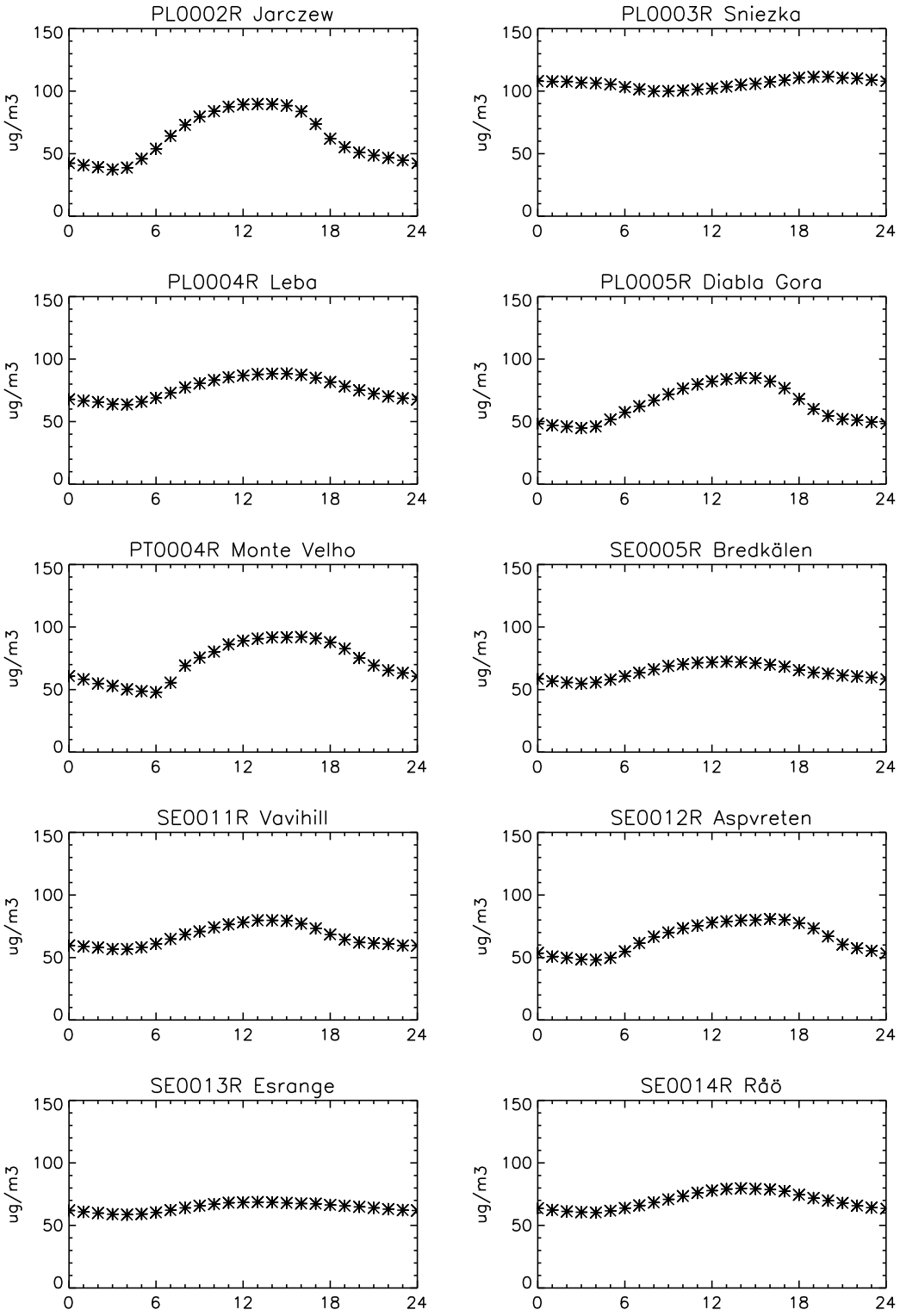

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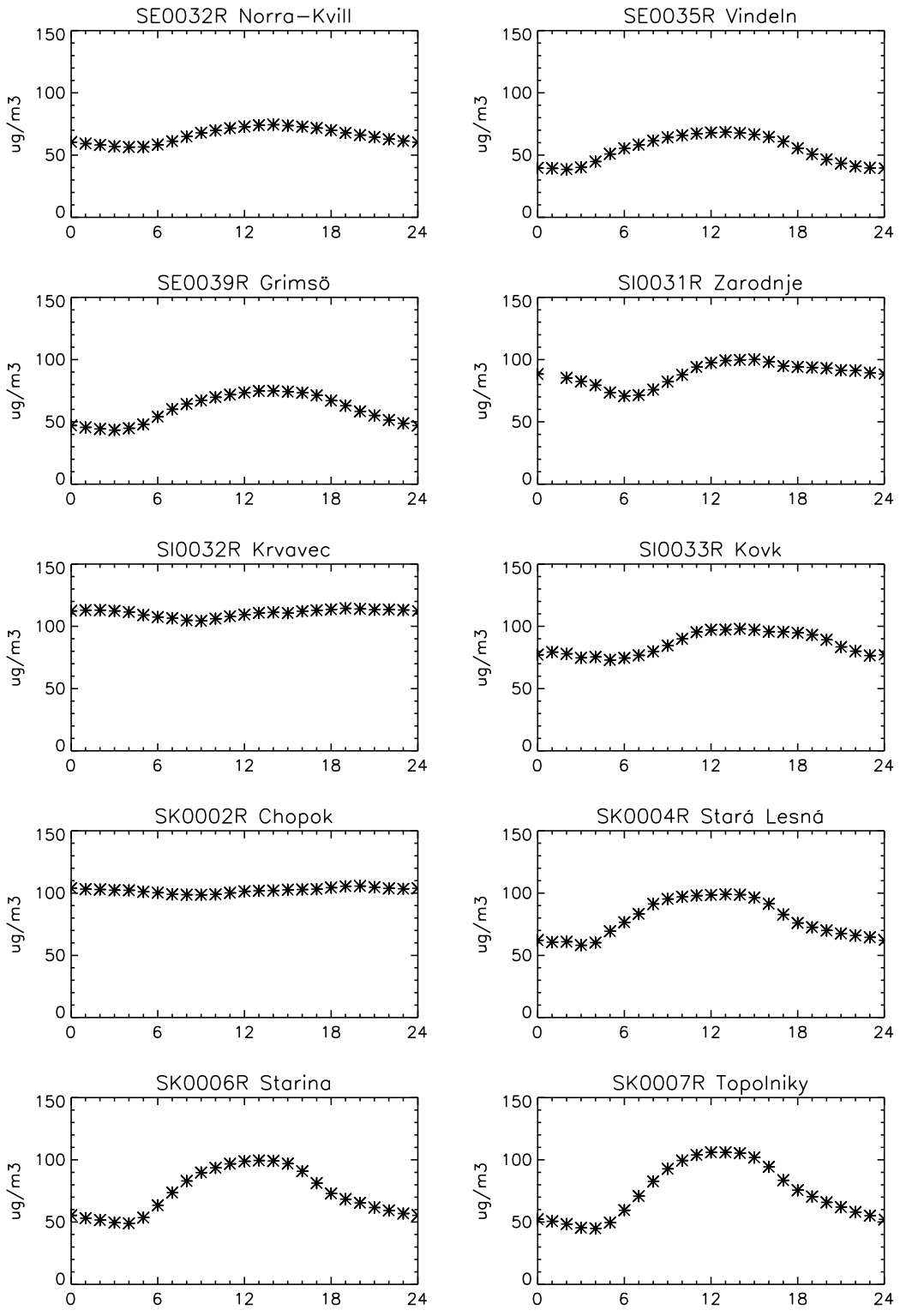

Figure 4.1, cont.

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

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EMEP/CCC-Report 2/2006 by A.M. Fjæraa.
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EMEP/CCC-Report 2/2007 by A.M. Fjæraa and A.-G. Hjellbrekke.
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Ozone measurements 2006.
EMEP/CCC-Report 2/2008 by A.M. Fjæraa and A.-G. Hjellbrekke.
Kjeller, Norwegian Institute for Air Research, 2008.

Ozone measurements 2007.
EMEP/CCC-Report 2/2009 by A.M. Fjæraa and A.-G. Hjellbrekke.
Kjeller, Norwegian Institute for Air Research, 2009.