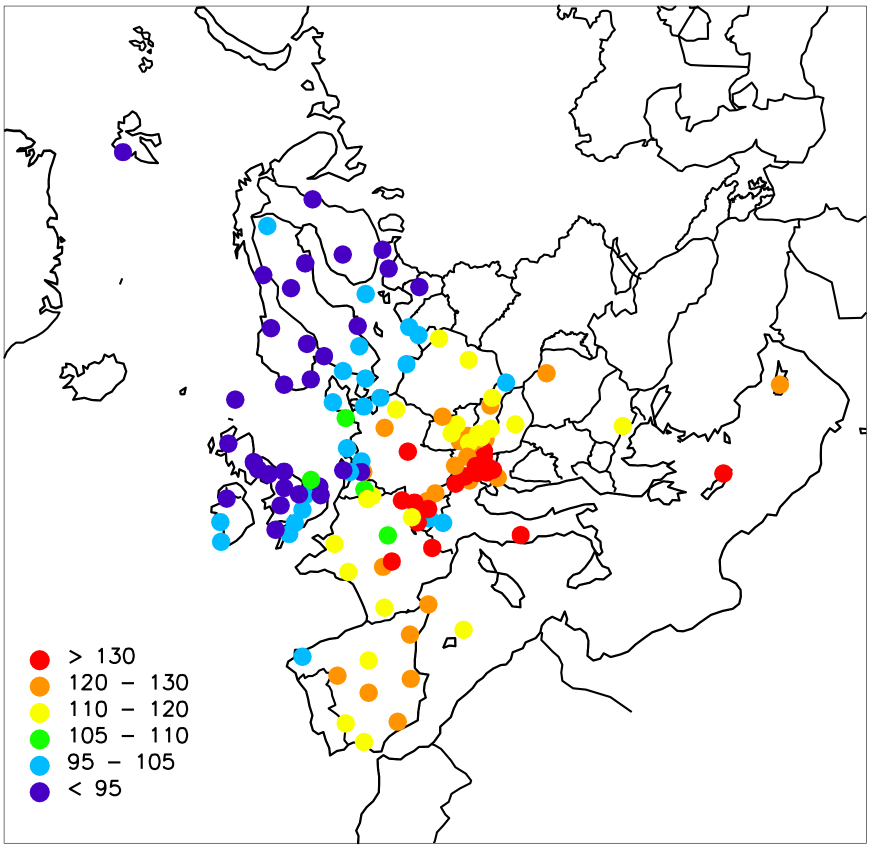
EMEP/CCC-Report 2/2012

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

Ozone measurements 2010

Anne-Gunn Hjellbrekke, Sverre Solberg and Ann Mari Fjæraa



95-percentile
April-September, µg/m^3

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Contents

Page

List of tables and figures

Ozone measurements 2010

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 2010 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 at 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.

EU has in the ozone directive (2002/3/EC) and the ambient air quality directive (2008/50/EC) defined a number of target values and long-term objectives for the protection of vegetation and human health. The target value, to be met by 1.1.2010, for human health is 120 µg/m^3 (8h mean) which 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 µg/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.

EU's long-term objective for the protection of human health defines 120 µg/m^3 as the maximum daily 8-hour mean value to occur within a calendar year. The long-term objective for the protection of vegetation is defined as an AOT40 value of 6000 µg/m^{3}h for the period May-July. Community progress towards attaining the long-term objective using the year 2020 as a benchmark shall be reviewed.

Within UN-ECE scientific evidence has caused the former AOT40-based critical levels for vegetation (Gothenburg Protocol of 1999) to be replaced by stomatal flux-based critical levels. Flux based critical levels have been developed to reflect that the real impacts depend on the amount of the pollutant transported into the leaves, whereas AOT40 are only based on the concentration of ozone in the atmosphere at the top of the plant canopy (Mills et al., 2011). The flux-based levels were discussed and reviewed at several occasions, such as the LRTAP workshops in Gothenburg (2003) and Obergurgl (2005), and in Ispra (November, 2009) and as part of the ICP Vegetation3 Task Force Meeting in Tervuren (February, 2010).

New flux-based critical levels for various types of vegetation have been approved for inclusion in LRTAP Convention's modelling and mapping manual (LRTAP, 2010). The DO_3SE model is used to estimate the stomatal ozone flux as a function of the ozone concentration at the leaf boundary layer, the transfer of ozone across this boundary layer, the stomatal conductance to ozone and the ozone deposition to the leaf cuticle. The accumulated stomatal flux over a specified time interval is estimated by the parameter POD_Y (the Phytotoxic Ozone Dose over a threshold flux of Y nmol m^{-2} PLA s$^{-1|}$). In this context, Y represents a detoxification threshold, below which it is assumed that any ozone absorbed by the plant will be detoxified. Thus, POD_Y can be described as the "effective dose" or "effective flux". POD_Y is the flux-based analogy to the concentration based AOT_x.

Concentration based critical levels (AOT_x) for estimating the risk of damage to vegetation are, however, still included where climatic data or suitable flux models are not available.

Flux based (POD_Y) and concentration based (AOT_x) critical levels have been identified for crops, forest, and (semi-)natural vegetation and are defined and described in detail in the "Modelling and mapping manual" (LRTAP, 2010). The concentration based critical level is 3000 ppb h (3-months period) for agricultural crops and (semi-)natural vegetation and 5000 ppb h (6-months period) for forest trees. The former critical level for forest was 10 000 ppb h, and the new, lower level is seen as a clear improvement compared to the former level (LRTAP, 2010). The "Modelling and mapping manual" strongly recommends that the critical levels should be based on the concentrations at the canopy height whereas the measurements normally are taken at 2 m height above ground. When meteorological measurements are not available it is recommended to adjust the measured data to values relevant for the canopy height by applying a given vertical profile depending on the type of vegetation.

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 background EMEP sites during 2010 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 2010. In total 131 stations from 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 2010.

Code	Station name	Country	Latitude	Longitude	Altitude
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	51 27 27 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	35 02 20 N	33 03 29 E	532
CZ0001R	Svratouch	Czech Republic	49 44 00 N	16 03 00 E	737
CZ0003R	Košetice	Czech Republic	49 35 00 N	15 05 00 E	534
DE0001R	Westerland	Germany	54 55 32 N	8 18 35 E	12
DE0002R	Waldhof	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
DK0012R	Risoe	Denmark	55 41 36 N	12 05 08 E	3
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
ES0001R	San Pablo de los Montes	Spain	39 32 52 N	4 20 55 W	917
ES0006R	Mahon	Spain	39 52 00 N	4 19 00 E	78
ES0007R	Viznar	Spain	37 14 00 N	3 32 00 W	1265
ES0009R	Campisábalos	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
ES0016R	O Saviñao	Spain	43 13 52 N	7 41 59 W	506
ES0017R	Doñana	Spain	37 01 49 N	6 19 54 W	5
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 (Sammaltunturi)	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
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 28 00 E	1750
FR0017R	Montfranc	France	45 48 00 N	2 04 00 E	810

Table 1, cont.

Code	Station name	Country	Latitude	Longitude	Altitude
FR0018R	La Coulonche	France	48 38 00 N	0 27 00 W	309
FR0019R	Pic du Midi	France	42 56 12 N	0 08 31 E	2877
FR0030R	Puy de Dôme	France	45 46 00 N	2 57 00 E	1465
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
GB0033R	Bush	United Kingdom	55 51 31 N	3 12 18 W	180
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
GB0045R	Wicken Fen	United Kingdom	52 17 54 N	0 17 34 W	5
GB0048R	Auchencorth Moss	United Kingdom	55 47 36 N	3 14 41 W	260
GB0049R	Weybourne	United Kingdom	52 57 02 N	1 07 19 E	16
GB0050R	St. Osyth	United Kingdom	51 46 41 N	1 04 56 E	8
GB0051R	Market Harborough	United Kingdom	52 33 16 N	0 46 20 W	145
GB0052R	Lerwick	United Kingdom	60 08 21 N	1 11 07 W	85
GB0053R	Charlton Mackrell	United Kingdom	51 03 22 N	2 41 00 W	54
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
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 09 43 N	21 10 23 E	18
LV0016R	Zoseni	Latvia	57 08 07 N	25 54 20 E	188
MK0007R	Lazaropole	Macedonia	41 19 12 N	20 25 12 E	1332
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
NL0011R	Cabauw	The Netherlands	51 58 12 N	4 55 48 E	60
NL0091R	De Zilk	The Netherlands	52 18 00 N	4 30 00 E	4
NO0002R	Birkenes II	Norway	58 23 18 N	8 15 07 E	219
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	Zeppelin mountain (Ny-Ålesund)	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 20 N	11 04 41 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
RO0008R	Poiana Stampei	Romania	47 19 29 N	25 08 04 E	908
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
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

Table 1, cont.

Code	Station name	Country	Latitude	Longitude	Altitude
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

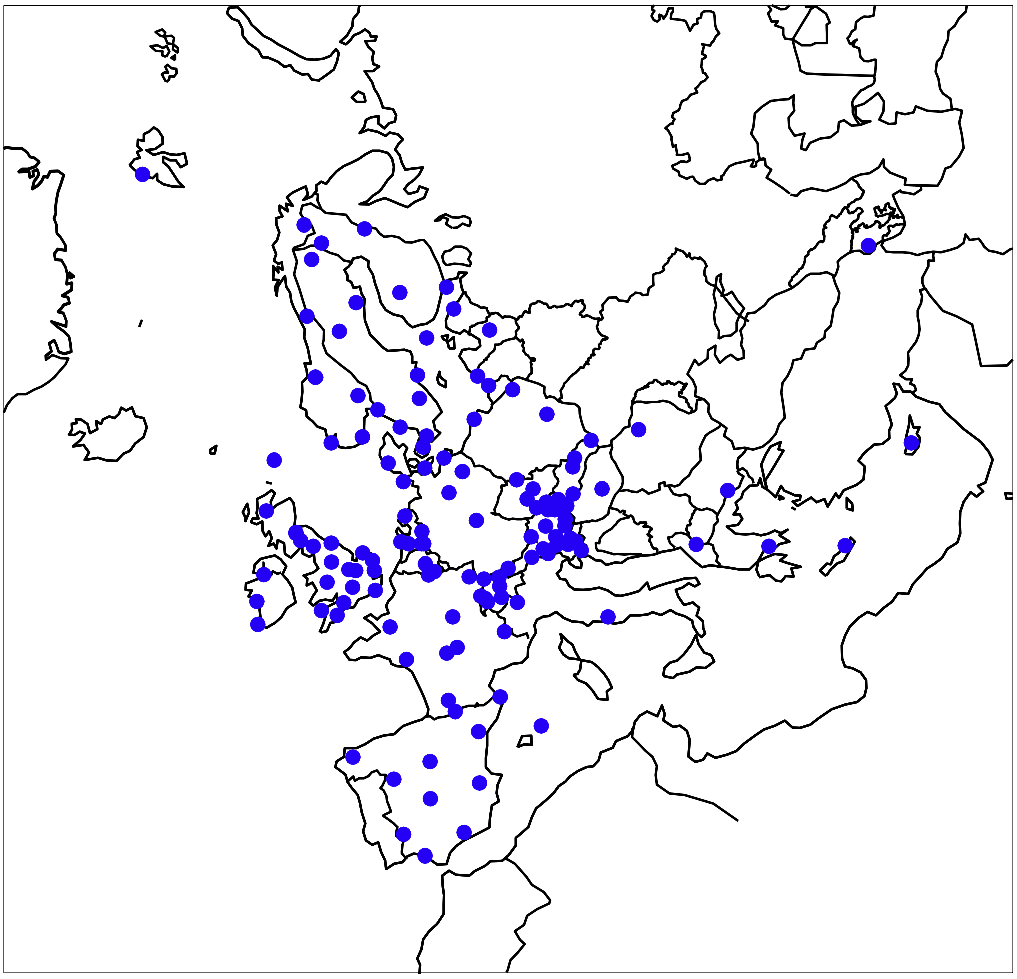

Figure 1: Location of the monitoring stations.

Until 10/09/2008, ozone has been measured at four different heights at Donon. Since 11/09/2008 ozone is measured at one sampling height, 3.5 m, at a new site next to the old deleted tower.

The monitoring stations are selected by the countries. Most of the stations are recognised as EMEP ozone stations. Information about the ozone data quality, calibration and maintenance procedures was in 2000 collected from the participants (Aas et al., 2000). An updated document, "Overview of the routines for calibration and maintenance", is also available under link "ozone at http://www.nilu.no/projects/ccc/emepdata.html.

A report on station representativeness has been written for the GEOmon project (Henne et al., 2010). The report can be downloaded at http://geomon.empa.ch/index.php#data.

The UV absorption method is the only measurement method in use in 2010.

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 Jungfraujoch (-8°C, 653 mbar). 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
Armenia	unknown
Austria	2.0
Belgium	unknown
Bulgaria	unknown
Cyprus	unknown
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	unknown
Netherlands	2.0
Norway	2.0
Poland	2.0
Portugal	1.96
Romania	unknown
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 data capture is in general good. 108 stations have a data capture above 90% and 117 above 85%.

Table 3: Data capture in per cent, 2010.

Code	Station	Data capture 2010
AT0002R	Illmitz	93.7
AT0005R	Vorhegg	89.6
AT0030R	Pillersdorf bei Retz	94.3
AT0032R	Sulzberg	94.8
AT0034G	Sonnblick	89.3
AT0037R	Zillertaler Alpen	81.1
AT0038R	Gerlitzen	96.1
AT0040R	Masenberg	93.6
AT0041R	Haunsberg	95.2
AT0042R	Heidenreichstein	93.8
AT0043R	Forsthof	94.1
AT0044R	Graz Platte	66.8
AT0045R	Dunkelsteinerwald	94.0
AT0046R	Gänserndorf	94.6
AT0047R	Stixneusiedl	94.6
AT0048R	Zoebelboden	90.7
AT0049R	Grebenzen bei St. Lamprecht	94.0
BE0001R	Offagne	94.5
BE0032R	Eupen	92.5
BE0035R	Vezin	93.4
BG0053R	Rojen peak	93.7
CH0001G	Jungfraujoch	97.0
CH0002R	Payerne	95.2
CH0003R	Tänikon	95.5
CH0004R	Chaumont	95.3
CH0005R	Rigi	94.9
CY0002R	Ayia Marina	94.2
CZ0001R	Svratouch	97.1
CZ0003R	Kosetice	99.0
DE0001R	Westerland	94.4
DE0002R	Waldhof	95.0
DE0003R	Schauinsland	94.9
DE0007R	Neuglobsow	94.1
DE0008R	Schmücke	93.7
DE0009R	Zingst	95.7
DK0005R	Keldsnor	89.6
DK0012R	Risoe	39.8
DK0031R	Ulborg	89.3
DK0041R	Lille Valby	34.4
EE0009R	Lahemaa	99.5
ES0001R	San Pablo de los Montes	99.4
ES0006R	Mahon	97.6
ES0007R	Viznar	96.2
ES0009R	Campisábalos	97.7
ES0010R	Cabo de Creus	96.4
ES0011R	Barcarrola	98.9
ES0012R	Zarra	96.0
ES0013R	Penausende	99.4
ES0014R	Els Torms	98.6
ES0016R	O Saviñao	95.7
ES0017R	Doñana	91.8

Table 3, cont.

Code	Station	Data capture 2010
FI0009R	Utö	95.1
FI0017R	Virolahti II	97.9
FI0022R	Oulanka	79.3
FI0037R	Ahtari II	98.7
FI0096G	Pallas (Sammaltunturi)	15.7
FR0008R	Donon	99.0
FR0009R	Revin	98.2
FR0010R	Morvan	94.5
FR0013R	Peyrusse Vieille	99.6
FR0014R	Montandon	98.1
FR0015R	La Tardière	99.5
FR0016R	Le Casset	98.0
FR0017R	Montfranc	95.5
FR0018R	La Coulonche	97.3
FR0019R	Pic du Midi	74.3
FR0030R	Puy de Dôme	85.5
GB0002R	Eskdalemuir	98.7
GB0006R	Lough Navar	99.6
GB0013R	Yarner Wood	99.3
GB0014R	High Muffles	92.3
GB0015R	Strath Vaich Dam	99.1
GB0031R	Aston Hill	98.9
GB0033R	Bush	99.4
GB0035R	Great Dun Fell	79.9
GB0036R	Harwell	99.1
GB0037R	Ladybower Res.	94.3
GB0038R	Lullington Heath	28.0
GB0039R	Sibton	99.8
GB0043R	Narberth	96.6
GB0045R	Wicken Fen	98.7
GB0048R	Auchencorth Moss	99.6
GB0049R	Weybourne	94.2
GB0050R	St. Osyth	97.0
GB0051R	Market Harborough	98.9
GB0052R	Lerwick	99.8
GB0053R	Charlton Mackrell	99.0
GR0001R	Aliartos	48.9
GR0002R	Finokalia	91.8
HU0002R	K-puszta	96.3
IE0001R	Valentia Observatory	97.7
IE0031R	Mace Head	99.9
IT0001R	Montelibretti	96.8
IT0004R	Ispra	85.9
LT0015R	Preila	97.9
LV0010R	Rucava	77.9
LV0016R	Zoseni	95.1
MK0007R	Lazaropole	47.7
NL0007R	Eibergen	98.8
NL0009R	Kollumerwaard	95.8
NL0010R	Vredepeel	96.2
NL0011R	Cabauw	97.6
NL0091R	De Zilk	85.7

Table 3, cont.

Code	Station	Data capture 2010
NO0002R	Birkenes II	94.4
NO0015R	Tustervatn	99.6
NO0039R	Kårvatn	99.5
NO0042G	Zeppelin mountain (Ny-Ålesund)	99.0
NO0043R	Prestebakke	99.7
NO0052R	Sandve	99.6
NO0055R	Karasjok	16.1
NO0056R	Hurdal	99.8
PL0002R	Jarczew	97.4
PL0003R	Sniezka	89.4
PL0004R	Leba	99.9
PL0005R	Diabla Gora	90.9
RO0008R	Poiana Stampei	84.0
SE0005R	Bredkälen	99.3
SE0011R	Vavihill	98.9
SE0012R	Aspvreten	95.5
SE0013R	Esrange	99.5
SE0014R	Råö	99.2
SE0032R	Norra-Kvill	98.6
SE0035R	Vindeln	98.7
SI0008R	Iskrba	86.9
SI0031R	Zarodnje	94.3
SI0032R	Krvavec	91.2
SI0033R	Kovk	94.6
SK0002R	Chopok	97.3
SK0004R	Stará Lesná	99.5
SK0006R	Starina	99.7
SK0007R	Topolniky	97.0

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% are required and an adjustment proportional to the number of missing data are applied, i.e. exposure index divided by the fraction of data available. This correction gives 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% is regarded as sufficient for the mapping.

5. Concentration summaries and episodes

The summer ozone situation in Europe in 2010 was similar to the previous three years. During the past decade, the summers of 2003 and 2006 had very large number of exceedances, principally due to very warm weather (EEA, 2011).

The highest one-hour ozone concentration in 2010 was measured at Dunkelsteinerwald in Austria (222 μg/m^3, June 11) (Table 1.1, Annex 1). In total concentrations above 200 μg/m^3 were measured at eight sites. The lowest maximum concentration was measured in Finland (Oulanka, 103 μg/m^3).

Exceedance of the information threshold of 180 μg/m^3 was observed at 29 sites (Belgium, UK, Switzerland and Italy) (Figure 1.4, Annex 1). This is much higher than 2008 and 2009 (7 sites each year). The unusual warm summers of 2003 and 2006 had 81 and 69 exceedances respectively.

The one hour critical level for ozone formulated by the ECE for protection of vegetation (150 μg/m^3) was exceeded at 87 sites (Figure 1.3, Annex 1), compared to 69 sites in 2009 and 112 sites in 2003.

Table 1.2 in Annex 1 shows the 25-, 50-, 75-, 90-, 95-, 98- and 99-precentiles 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 northern parts of Scandinavia and United Kingdom, and in the Baltics, where the 99-percentiles are below 120 μg/m^3. The concentrations are higher in Denmark, southern parts of United Kingdom and in the Alps region where the 99-percentiles generally ranges from 120-140 μg/m^3, and at its highest in Germany, France, Italy and Spain where the 99-persentile values are above 140 μg/m^3.

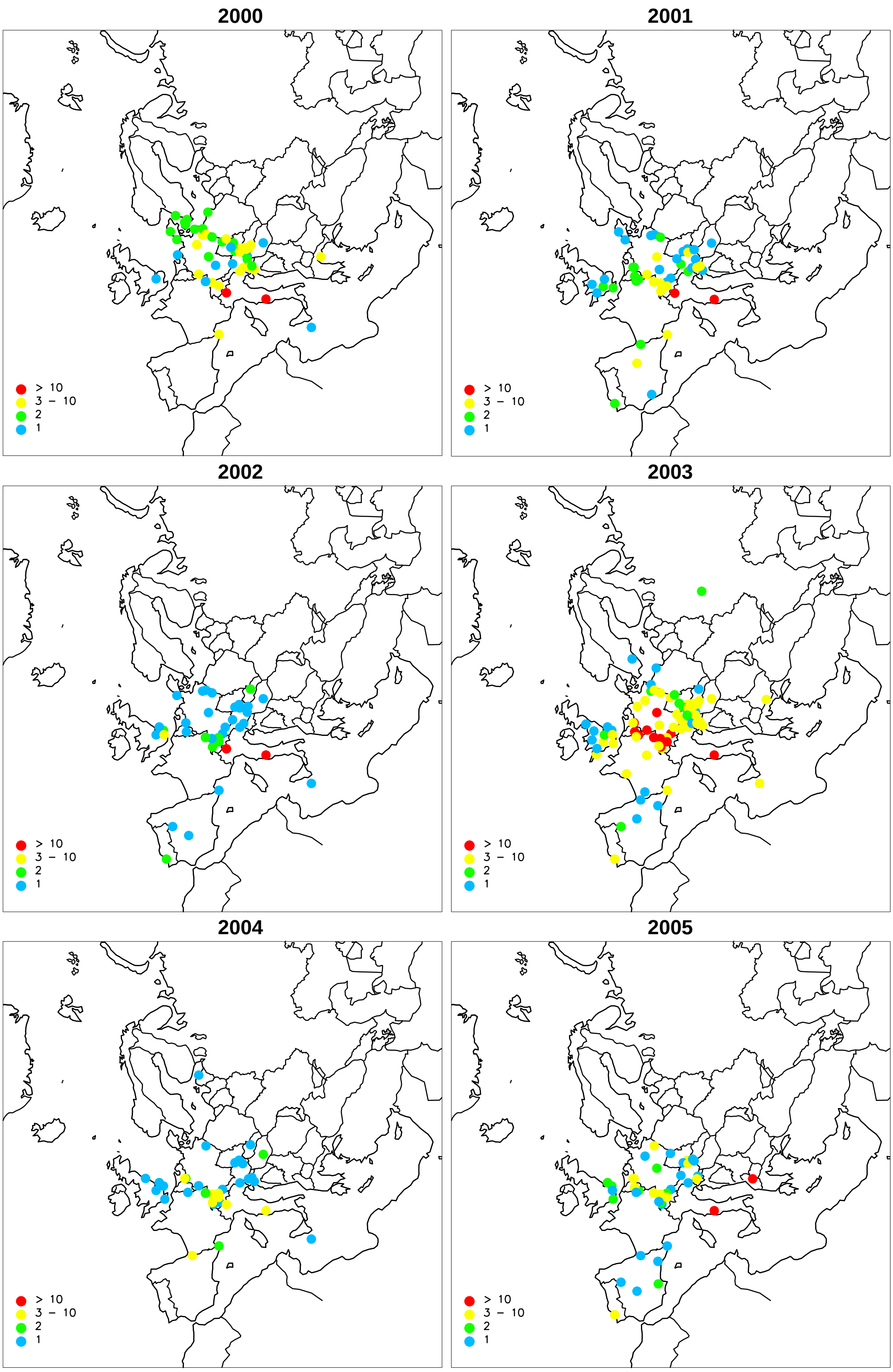

Figure 2: Number of exceedances of the threshold value of 180 µg/m³ 2000-2010. (Unit: number of days.) Stations with zero exceedances are not shown.

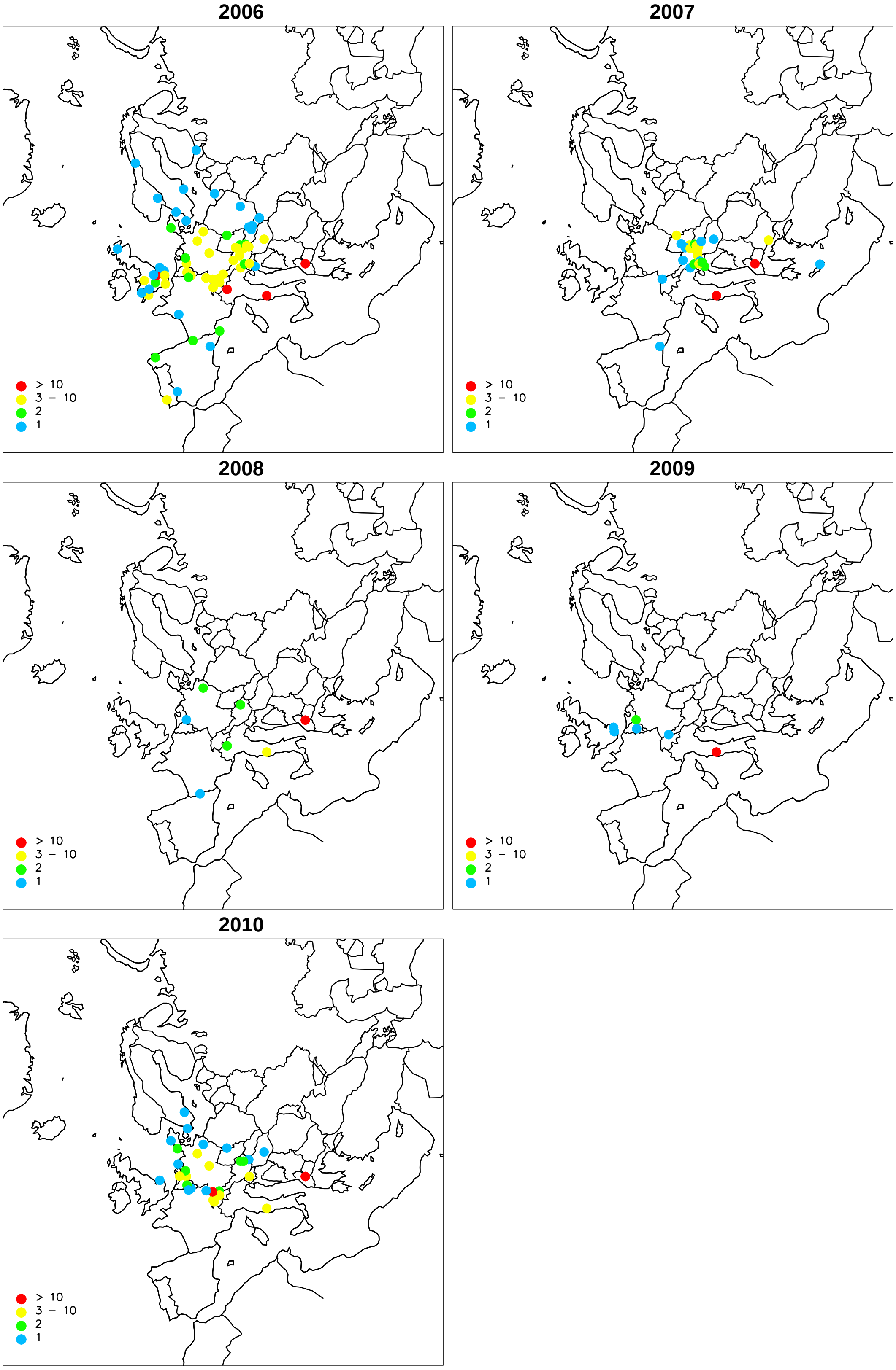

Figure 2, cont.

6. Calculation of AOT40

AOT40 and AOT60 for forest and agricultural corps for 2010 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. Low values are found in most parts of Northern Europe, while the highest values are found in Central Europe. Five sites in Europe (Greece, Slovenia, Germany, Austria and France) have AOT40 (May-July) values above 15 000 ppbh. The critical level for forest in April-September (5 000 ppbh) is exceeded at most sites in Central, Eastern and Southern Europe.

7. Seasonal variation

Monthly mean concentrations for 2010 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 1990-2010 are given in Figure 3.1 in Annex 3. The seasonal variation of ozone shows a 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) 2010 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. Zeppelin-fjellet 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 June 14th, 2012.

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, http://ebas.nilu.no and http://www.nilu.no/projects/ccc/index.html.

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11. Acknowledgements

A large number of co-workers in participating countries have been involved in the many steps of collection of EMEP's measurement data. A list of participating institutes can be seen below. The staff at CCC wishes to express their gratitude and appreciation for continued good co-operation and efforts.

Closer at home the secretarial work, and far beyond, has been performed by Ms. Kristine Aasarød. Rita Larsen Våler and Mona Waagsbø have been very helpful with data flow and database maintenance.

12. List of participating institutions

Armenia	Environmental Impact Monitoring Centre
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
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	Center for Physical Sciences and Technology
Macedonia	Ministry of Environment and Physical Planning
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
Romania	National Environmental Protection Agency
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 $\mu g/m^3$ and maximum concentrations in 2010.

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)
AT0002R	Illmitz	8207	364	237	39	39	8	3	1	0	0	183	02.07.2010
AT0005R	Vorhegg	7845	346	290	38	9	6	0	0	0	0	159	01.07.2010
AT0030R	Pillersdorf bei Retz	8262	363	222	39	12	4	0	0	0	0	174	16.07.2010
AT0032R	Sulzberg	8305	364	360	36	13	5	0	0	0	0	166	21.07.2010
AT0034G	Sonnblick	7824	348	798	80	13	5	0	0	0	0	160	01.07.2010
AT0037R	Zillertaler Alpen	7105	310	575	51	37	5	0	0	0	0	164	03.07.2010, 04.07.2010
AT0038R	Gerlitzen	8420	365	927	80	54	9	0	0	0	0	163	02.07.2010
AT0040R	Masenberg	8199	361	443	44	36	8	0	0	0	0	171	15.07.2010
AT0041R	Haunsberg	8338	365	392	46	44	9	0	0	0	0	171	03.07.2010
AT0042R	Heidenreichstein	8217	363	218	35	7	3	0	0	0	0	166	16.07.2010
AT0043R	Forsthof	8247	365	332	38	47	12	3	2	0	0	199	02.07.2010
AT0044R	Graz Platte	5848	256	550	54	48	8	0	0	0	0	168	25.05.2010
AT0045R	Dunkelsteinerwald	8234	365	197	37	24	12	4	2	2	1	222	11.06.2010
AT0046R	Gänserndorf	8290	365	192	36	27	12	0	0	0	0	171	15.07.2010
AT0047R	Stixneusiedl	8290	365	208	31	33	7	0	0	0	0	178	15.07.2010
AT0048R	Zoebelboden	7941	355	310	37	28	7	0	0	0	0	165	03.07.2010
AT0049R	Grebenzen bei St. Lamprecht	8236	361	607	61	29	5	0	0	0	0	161	01.07.2010
BE0001R	Offagne	8277	357	197	25	27	5	1	1	0	0	182	10.07.2010
BE0032R	Eupen	8099	353	213	25	52	10	9	3	0	0	196	28.06.2010
BE0035R	Vezin	8186	356	119	21	36	7	4	2	0	0	195	28.06.2010
BG0053R	Rojen peak	8205	365	50	13	0	0	0	0	0	0	143.4	14.08.2010
CH0001G	Jungfraujoch	8500	365	13	5	2	2	0	0	0	0	154.3	22.06.2010
CH0002R	Payerne	8340	365	336	45	70	14	12	3	0	0	187.6	30.06.2010
CH0003R	Tänikon	8366	365	308	50	69	14	6	2	0	0	186.1	21.07.2010
CH0004R	Chaumont	8352	365	666	52	183	18	18	5	0	0	189.9	10.07.2010
CH0005R	Rigi	8317	364	590	45	141	18	18	6	1	1	203.9	10.07.2010
CY0002R	Ayia Marina	8256	360	531	87	8	3	0	0	0	0	156.9	26.07.2010
CZ0001R	Svratouch	8503	358	216	36	0	0	0	0	0	0	147.2	01.07.2010
CZ0003R	Košetice	8672	363	198	30	14	3	0	0	0	0	163	02.07.2010

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)
DE0001R	Westerland	8267	365	110	15	39	7	8	2	0	0	195.4	02.07.2010
DE0002R	Waldhof	8319	364	218	33	80	10	16	3	4	2	204.1	09.07.2010
DE0003R	Schauinsland	8317	362	837	59	309	28	69	13	7	2	219.6	10.07.2010
DE0007R	Neuglobsow	8246	365	134	21	35	10	3	1	0	0	186.3	10.07.2010
DE0008R	Schmücke	8204	361	500	46	152	19	16	4	0	0	193.5	09.07.2010
DE0009R	Zingst	8386	365	81	13	11	2	0	0	0	0	169.5	11.07.2010
DK0005R	Keldsnor	7851	362	60	11	9	4	0	0	0	0	171.2	10.07.2010
DK0012R	Risoe	3483	162	2	1	0	0	0	0	0	0	128.8	31.07.2010
DK0031R	Ulborg	7823	360	64	10	14	3	6	1	2	1	203	02.07.2010
DK0041R	Lille Valby	3013	138	0	0	0	0	0	0	0	0	119.9	29.04.2010
EE0009R	Lahemaa	8715	365	16	7	0	0	0	0	0	0	132	11.07.2010
ES0001R	San Pablo de los Montes	8711	365	400	51	9	4	0	0	0	0	163.9	12.08.2010
ES0006R	Mahon	8551	363	75	17	0	0	0	0	0	0	135.8	02.07.2010
ES0007R	Viznar	8423	365	388	79	7	3	0	0	0	0	167.8	06.07.2010
ES0009R	Campisábalos	8560	365	180	36	11	5	0	0	0	0	179.8	20.07.2010
ES0010R	Cabo de Creus	8446	356	272	45	4	2	0	0	0	0	177.9	01.07.2010
ES0011R	Barcarrola	8663	365	122	21	0	0	0	0	0	0	139.1	01.07.2010
ES0012R	Zarra	8410	353	410	69	8	6	0	0	0	0	162	02.07.2010
ES0013R	Penausende	8707	365	317	42	15	6	0	0	0	0	158.9	01.08.2010
ES0014R	Els Torms	8635	365	289	42	1	1	0	0	0	0	150.2	22.05.2010
ES0016R	O Saviñao	8380	365	38	11	2	1	0	0	0	0	162.2	23.05.2010
ES0017R	Do±ana	8044	361	90	22	1	1	0	0	0	0	150.7	25.08.2010
FI0009R	Utö	8332	353	30	7	1	1	0	0	0	0	151	13.07.2010
FI0017R	Virolahti II	8576	365	32	8	2	1	0	0	0	0	174	26.07.2010
FI0022R	Oulanka	6948	296	0	0	0	0	0	0	0	0	103	04.07.2010
FI0037R	Ahtari II	8649	365	8	2	0	0	0	0	0	0	136	29.07.2010
FI0096G	Pallas (Sammaltunturi)	1374	59	0	0	0	0	0	0	0	0	89	13.01.2010, 14.01.2010
FR0008R	Donon	8676	364	367	27	46	8	1	1	0	0	184	02.07.2010
FR0009R	Revin	8606	363	172	23	16	3	1	1	0	0	181	28.06.2010
FR0010R	Morvan	8279	357	56	13	0	0	0	0	0	0	147	29.06.2010
FR0013R	Peyrusse Vieille	8728	365	143	26	1	1	0	0	0	0	151	08.07.2010
FR0014R	Montandon	8594	361	195	27	18	6	0	0	0	0	163	10.07.2010

Table 1.1, cont.

Code	Station	Total		>120		>150		>180		>200		Max concentrations	
		hours	days	hours	days	hours	days	hours	days	hours	days	µg/m³	day(s)
FR0015R	La Tardière	8720	365	103	22	0	0	0	0	0	0	149	09.07.2010
FR0016R	Le Casset	8584	360	773	70	0	0	0	0	0	0	150	16.04.2010
FR0017R	Montfranc	8366	357	423	34	5	3	0	0	0	0	153	30.06.2010
FR0018R	La Coulonche	8524	359	182	26	8	3	0	0	0	0	155	08.07.2010, 20.07.2010
FR0019R	Pic du Midi	6508	281	405	60	16	5	0	0	0	0	175	17.05.2010
FR0030R	Puy de Dôme	7487	332	564	48	16	6	0	0	0	0	173	09.07.2010
GB0002R	Eskdalemuir	8642	364	6	1	0	0	0	0	0	0	134	04.06.2010
GB0006R	Lough Navar	8727	365	4	2	0	0	0	0	0	0	136	23.05.2010
GB0013R	Yarner Wood	8695	365	28	7	4	1	0	0	0	0	168	04.06.2010
GB0014R	High Muffles	8089	340	16	3	0	0	0	0	0	0	138	05.06.2010
GB0015R	Strath Vaich Dam	8681	364	0	0	0	0	0	0	0	0	118	12.04.2010
GB0031R	Aston Hill	8660	365	0	0	0	0	0	0	0	0	120	24.04.2010, 04.06.2010
GB0033R	Bush	8707	365	5	1	0	0	0	0	0	0	148	05.06.2010
GB0035R	Great Dun Fell	6998	301	0	0	0	0	0	0	0	0	112	26.06.2010
GB0036R	Harwell	8680	365	37	7	0	0	0	0	0	0	150	04.06.2010
GB0037R	Ladybower Res.	8265	350	22	5	0	0	0	0	0	0	142	26.06.2010
GB0038R	Lullington Heath	2456	104	0	0	0	0	0	0	0	0	72	22.10.2010, 08.11.2010, 11.11.2010, 12.11.2010
GB0039R	Sibton	8741	365	21	3	7	2	0	0	0	0	174	27.06.2010
GB0043R	Narberth	8464	359	6	2	0	0	0	0	0	0	126	04.06.2010
GB0045R	Wicken Fen	8646	365	23	5	1	1	0	0	0	0	152	20.07.2010
GB0048R	Auchencorth Moss	8728	365	10	2	0	0	0	0	0	0	140	05.06.2010
GB0049R	Weybourne	8248	348	81	15	27	5	2	1	0	0	194	27.06.2010
GB0050R	St. Osyth	8493	361	7	3	2	1	0	0	0	0	156	20.07.2010
GB0051R	Market Harborough	8668	365	24	4	2	1	0	0	0	0	156	05.06.2010
GB0052R	Lerwick	8740	365	0	0	0	0	0	0	0	0	110	25.04.2010
GB0053R	Charlton Mackrell	8674	365	27	6	3	1	0	0	0	0	156	04.06.2010
GR0001R	Aliartos	4283	191	51	15	0	0	0	0	0	0	146	25.05.2010
GR0002R	Finokalia	8042	347	2372	172	155	30	0	0	0	0	169.9	22.07.2010, 16.09.2010
HU0002R	K-puszta	8439	356	167	36	10	2	2	1	0	0	190	14.07.2010
IE0001R	Valentia Observatory	8558	359	29	6	2	1	0	0	0	0	154.2	11.04.2010
IE0031R	Mace Head	8755	365	2	1	0	0	0	0	0	0	124	05.04.2010

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)
IT0001R	Montelibretti	8479	355	358	79	71	28	4	3	0	0	183.7	02.07.2010
IT0004R	Ispra	7521	328	18	8	1	1	0	0	0	0	154.6	02.07.2010
LT0015R	Preila	8579	363	37	11	0	0	0	0	0	0	149.5	30.04.2010
LV0010R	Rucava	6826	292	32	10	3	2	0	0	0	0	157	30.04.2010
LV0016R	Zoseni	8328	350	4	3	0	0	0	0	0	0	125	13.04.2010, 10.07.2010
MK0007R	Lazaropole	4175	195	1845	144	491	63	48	11	4	1	219	14.08.2010
NL0007R	Eibergen	8657	364	136	20	49	8	7	2	0	0	195.2	09.07.2010
NL0009R	Kollumerwaard	8394	359	66	12	15	4	7	1	0	0	194.4	09.07.2010
NL0010R	Vredepeel	8424	360	63	12	5	2	0	0	0	0	158.5	08.07.2010
NL0011R	Cabauw	8553	361	101	18	42	8	14	3	1	1	203.6	09.07.2010
NL0091R	De Zilk	7503	320	30	5	4	2	0	0	0	0	160.1	05.06.2010
NO0002R	Birkenes II	8266	347	1	1	0	0	0	0	0	0	121.8	21.07.2010
NO0015R	Tustervatn	8725	365	0	0	0	0	0	0	0	0	119.8	16.05.2010
NO0039R	Kårvatn	8713	365	3	1	0	0	0	0	0	0	123.3	26.04.2010
NO0042G	Zeppelin mountain (Ny-Ålesund)	8675	365	0	0	0	0	0	0	0	0	106.3	01.04.2010
NO0043R	Prestebakke	8733	365	19	4	0	0	0	0	0	0	144.6	29.06.2010
NO0052R	Sandve	8725	365	1	1	0	0	0	0	0	0	121.2	21.07.2010
NO0055R	Karasjok	1413	59	0	0	0	0	0	0	0	0	92.8	11.01.2010
NO0056R	Hurdal	8739	365	2	1	0	0	0	0	0	0	129.8	29.06.2010
PL0002R	Jarczew	8531	364	128	29	1	1	0	0	0	0	153	22.07.2010
PL0003R	Sniezka	7833	331	316	44	20	4	1	1	0	0	181	22.07.2010
PL0004R	Leba	8753	365	16	3	0	0	0	0	0	0	140	30.04.2010
PL0005R	Diabla Gora	7963	334	135	27	4	1	0	0	0	0	154	12.04.2010
RO0008R	Poiana Stampei	7357	324	240	53	9	3	0	0	0	0	155.4	16.05.2010
SE0005R	Bredkälen	8697	365	0	0	0	0	0	0	0	0	110	26.04.2010
SE0011R	Vavihill	8665	365	62	17	11	2	2	1	0	0	196	10.07.2010
SE0012R	Aspvreten	8369	352	25	5	0	0	0	0	0	0	145	11.07.2010
SE0013R	Esrange	8719	365	4	1	0	0	0	0	0	0	122	17.05.2010
SE0014R	Råö	8687	365	69	13	0	0	0	0	0	0	149	14.07.2010
SE0032R	Norra-Kvill	8636	365	48	9	11	2	4	1	2	1	216	10.07.2010
SE0035R	Vindeln	8649	365	7	1	0	0	0	0	0	0	148	15.05.2010

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)
SI0008R	Iskrba	7613	334	335	46	5	1	0	0	0	0	158	21.04.2010
SI0031R	Zarodnje	8258	365	482	49	51	14	0	0	0	0	173	15.07.2010
SI0032R	Krvavec	7993	358	1196	97	133	23	14	3	0	0	187	01.07.2010, 02.07.2010
SI0033R	Kovk	8286	364	574	53	57	11	0	0	0	0	172	22.07.2010
SK0002R	Chopok	8520	358	402	49	11	4	0	0	0	0	164	03.07.2010
SK0004R	Stará Lesná	8712	365	150	30	0	0	0	0	0	0	145	01.05.2010, 02.05.2010
SK0006R	Starina	8735	365	16	4	0	0	0	0	0	0	132	02.05.2010
SK0007R	Topolniky	8498	364	187	41	11	6	0	0	0	0	170	14.07.2010

Table 1.2: Percentiles of hourly ozone values April–September 2010.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
AT0002R	Illmitz	53.0	71.0	90.0	110.0	123.0	137.0	150.0	92.8
AT0005R	Vorhegg	60.0	82.0	99.0	115.0	126.0	139.0	144.0	90.6
AT0030R	Pillersdorf bei Retz	56.0	71.0	89.0	108.0	121.4	136.0	143.0	94.1
AT0032R	Sulzberg	69.0	81.0	98.0	118.0	130.0	138.0	142.0	94.3
AT0034G	Sonnblick	94.0	105.0	117.0	128.0	133.0	141.0	146.5	89.8
AT0037R	Zillertaler Alpen	80.0	93.0	109.0	125.0	133.0	140.0	149.2	93.0
AT0038R	Gerlitzen	91.0	104.0	118.0	132.0	139.0	147.0	151.6	96.5
AT0040R	Masenberg	72.0	89.0	104.0	122.0	133.0	144.0	149.0	94.1
AT0041R	Haunsberg	62.0	79.0	98.0	119.0	130.0	143.1	151.0	95.5
AT0042R	Heidenreichstein	50.0	70.0	90.0	108.7	122.0	132.1	139.1	93.2
AT0043R	Forsthof	61.0	79.0	96.0	115.4	128.7	143.0	152.0	94.4
AT0044R	Graz Platte	73.0	92.0	109.0	126.0	135.0	147.0	152.0	86.1
AT0045R	Dunkelsteinerwald	45.0	64.0	84.0	104.0	119.0	138.0	146.7	94.0
AT0046R	Gänserndorf	49.0	66.0	85.0	106.0	119.0	139.0	147.0	94.9
AT0047R	Stixneusiedl	54.0	70.0	90.0	109.0	120.0	137.0	148.0	94.9
AT0048R	Zoebelboden	67.0	82.0	100.0	116.0	125.0	137.8	147.0	94.7
AT0049R	Grebenzen bei St. Lamprecht	85.0	99.0	113.0	125.0	133.0	144.0	149.0	92.5
BE0001R	Offagne	44.0	60.0	79.0	102.0	119.0	134.0	143.8	96.0
BE0032R	Eupen	37.0	55.0	76.0	102.0	122.0	142.0	157.5	92.1
BE0035R	Vezin	28.0	50.0	71.0	90.0	106.0	131.2	147.2	95.4
BG0053R	Rojen peak	77.1	88.5	99.0	107.0	111.1	116.9	121.1	93.9
CH0001G	Jungfraujoch	72.3	80.7	89.4	97.1	102.4	106.9	110.2	97.2
CH0002R	Payerne	47.8	69.3	90.5	113.2	130.3	146.0	159.2	95.2
CH0003R	Tänikon	44.5	63.4	86.0	113.2	129.3	146.1	156.6	95.5
CH0004R	Chaumont	75.9	88.7	106.2	132.2	147.3	162.1	171.5	95.2
CH0005R	Rigi	72.5	85.7	104.6	128.2	142.4	160.9	170.2	94.4
CY0002R	Ayia Marina	88.9	102.5	113.3	122.3	128.0	134.6	139.7	92.7
CZ0001R	Svratouch	58.9	73.6	93.4	110.5	119.9	127.1	133.4	98.7
CZ0003R	Košetice	52.9	69.8	88.2	107.9	118.9	131.5	139.7	98.9
DE0001R	Westerland	66.4	77.3	87.9	98.3	106.6	128.5	148.4	95.2
DE0002R	Waldhof	45.4	63.3	81.9	103.9	120.7	148.8	163.8	95.3
DE0003R	Schauinsland	83.9	97.3	114.6	140.6	160.1	178.1	186.0	94.0
DE0007R	Neuglobsow	49.0	66.7	84.9	101.1	111.9	130.4	147.0	93.2
DE0008R	Schmücke	67.3	80.8	101.3	124.1	143.1	162.2	171.4	92.5
DE0009R	Zingst	56.0	67.2	79.3	90.9	102.6	119.1	131.3	95.9
DK0005R	Keldsnor	54.4	65.7	77.0	88.5	96.8	115.8	128.8	89.2
DK0012R	Risoe	46.7	60.8	71.4	80.0	85.2	93.5	101.8	34.1
DK0031R	Ulborg	59.4	70.7	81.6	91.3	99.4	115.0	129.4	88.6
DK0041R	Lille Valby	61.8	75.8	84.9	92.1	96.2	100.7	103.5	23.6
EE0009R	Lahemaa	20.0	43.0	64.0	82.0	93.0	105.0	115.0	99.3
ES0001R	San Pablo de los Montes	83.8	94.8	108.2	119.2	125.4	132.8	136.5	99.4
ES0006R	Mahon	75.3	85.7	96.1	106.2	112.5	119.1	122.8	97.5
ES0007R	Viznar	82.0	95.3	109.0	119.5	127.0	135.8	141.4	94.3
ES0009R	Campisábalos	66.2	83.5	96.5	109.4	118.0	126.9	133.5	96.5
ES0010R	Cabo de Creus	75.3	86.5	99.8	113.4	122.1	129.5	135.5	99.6
ES0011R	Barcarrola	56.1	72.8	88.6	104.1	114.1	123.9	128.5	98.9
ES0012R	Zarra	82.4	95.3	107.9	119.5	127.3	135.8	138.8	99.5
ES0013R	Penausende	70.8	86.4	100.8	115.5	125.3	135.4	142.4	99.7
ES0014R	Els Torms	70.7	86.3	101.5	115.8	122.4	128.7	131.8	98.6
ES0016R	O Saviñao	45.2	61.2	79.1	94.2	102.9	112.0	119.0	94.9
ES0017R	Doñana	53.2	74.0	90.3	103.8	111.7	121.2	125.2	88.0
FI0009R	Utö	59.0	69.0	79.0	90.0	99.0	110.0	117.0	98.5
FI0017R	Virolahti II	42.0	56.0	69.0	82.0	94.0	109.0	118.0	98.1
FI0022R	Oulanka	44.0	55.0	68.0	79.0	84.0	88.0	90.0	98.0
FI0037R	Ahtari II	42.0	56.0	70.0	81.0	88.0	99.0	108.5	99.0
FR0008R	Donon	56.0	71.0	89.0	116.0	133.0	144.0	151.0	98.7
FR0009R	Revin	48.0	62.0	80.0	102.0	117.0	131.0	139.0	96.7
FR0010R	Morvan	50.0	65.0	80.0	96.0	106.0	117.0	123.0	92.1
FR0013R	Peyrusse Vieille	57.0	73.0	89.0	106.0	116.0	124.0	128.0	99.5
FR0014R	Montandon	44.0	61.0	79.0	100.0	118.0	134.0	144.0	99.7
FR0015R	La Tardière	48.0	64.0	80.0	97.0	111.0	122.0	127.0	99.5
FR0016R	Le Casset	91.0	103.0	116.0	128.0	133.0	138.0	140.0	96.8
FR0017R	Montfranc	67.0	83.0	99.0	121.0	130.0	137.0	141.0	92.6
FR0018R	La Coulonche	60.0	75.0	90.0	107.0	119.0	130.0	137.0	95.7
FR0019R	Pic du Midi	91.0	102.0	113.0	125.0	132.6	140.0	145.0	59.4
FR0030R	Puy de Dôme	77.0	90.0	107.0	126.0	133.0	139.0	142.3	92.6

Table 1.2, cont.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
GB0002R	Eskdalemuir	42.0	56.0	68.0	80.0	86.0	94.0	98.0	98.1
GB0006R	Lough Navar	36.0	52.0	66.0	80.0	88.0	100.0	106.0	99.6
GB0013R	Yarner Wood	50.0	62.0	78.0	92.0	100.0	112.0	118.0	99.2
GB0014R	High Muffles	54.0	66.0	78.0	88.0	94.0	102.0	108.0	85.6
GB0015R	Strath Vaich Dam	46.0	60.0	72.0	84.0	90.0	96.0	100.0	99.7
GB0031R	Aston Hill	48.0	58.0	70.0	80.0	88.0	98.0	104.0	98.7
GB0033R	Bush	48.0	58.0	72.0	82.0	88.0	94.0	98.0	99.5
GB0035R	Great Dun Fell	48.0	58.0	72.0	82.0	86.0	92.0	98.5	92.7
GB0036R	Harwell	46.0	60.0	74.0	88.0	96.0	108.0	120.0	99.0
GB0037R	Ladybower Res.	50.0	62.0	74.0	86.0	92.0	102.0	110.0	94.3
GB0039R	Sibton	44.0	60.0	74.0	86.0	94.0	104.0	112.0	99.8
GB0043R	Narberth	46.0	58.0	72.0	86.0	92.0	98.0	106.0	97.2
GB0045R	Wicken Fen	32.0	52.0	72.0	88.0	96.0	106.0	112.0	98.8
GB0048R	Auchencorth Moss	46.0	56.0	70.0	80.0	86.0	92.0	98.0	99.7
GB0049R	Weybourne	60.0	76.0	90.0	102.0	110.0	122.0	142.0	90.2
GB0050R	St. Osyth	40.0	56.0	70.0	82.0	88.0	96.0	104.0	95.6
GB0051R	Market Harborough	38.0	52.0	70.0	82.0	89.0	100.0	110.0	99.0
GB0052R	Lerwick	52.0	64.0	76.0	84.0	88.0	90.0	94.0	99.8
GB0053R	Charlton Mackrell	46.0	62.0	74.0	88.0	96.0	106.0	116.0	99.3
GR0001R	Aliartos	35.0	64.0	91.0	106.0	114.0	120.0	122.0	64.5
GR0002R	Finokalia	109.5	121.2	131.8	142.6	147.8	154.4	158.4	95.5
HU0002R	K-puszta	39.0	62.0	89.0	108.6	118.0	128.0	137.0	98.4
IE0001R	Valentia Observatory	51.6	62.0	71.4	85.2	95.2	106.1	115.5	97.1
IE0031R	Mace Head	60.0	68.0	80.0	90.0	96.0	102.0	108.0	99.9
IT0001R	Montelibretti	26.4	58.5	93.0	116.4	131.5	147.7	159.1	93.8
IT0004R	Ispra	35.5	48.5	67.9	86.8	96.9	106.9	114.7	81.5
LT0015R	Preila	55.7	71.3	83.7	94.4	103.2	112.9	117.9	97.8
LV0010R	Rucava	42.0	63.0	78.0	91.0	98.0	110.0	118.0	99.0
LV0016R	Zoseni	37.0	51.0	63.0	76.0	83.0	90.0	98.0	99.2
MK0007R	Lazaropole	112.0	130.0	145.0	158.0	168.0	182.0	188.0	52.3
NL0007R	Eibergen	25.9	45.8	66.2	85.5	102.3	136.9	155.6	99.5
NL0009R	Kollumerwaard	42.2	60.2	77.3	90.5	98.4	114.1	130.3	95.5
NL0010R	Vredepeel	22.8	41.0	57.9	74.8	90.0	113.9	127.4	98.6
NL0011R	Cabauw	28.0	49.5	68.8	88.1	101.2	123.1	148.3	99.8
NL0091R	De Zilk	33.9	52.3	67.4	77.6	84.3	96.1	116.5	81.1
NO0002R	Birkenes II	54.0	65.9	78.5	89.5	94.9	100.9	106.6	99.8
NO0015R	Tustervatn	46.4	60.6	77.8	89.7	93.4	99.7	103.6	99.6
NO0039R	Kårvatn	29.3	51.6	70.5	86.4	94.6	99.8	102.6	99.5
NO0042G	Zeppelin mountain (Ny-Ålesund)	53.6	61.5	70.9	85.8	93.2	98.7	100.7	99.3
NO0043R	Prestebakke	47.2	60.0	73.4	86.0	92.3	99.8	105.5	99.7
NO0052R	Sandve	52.4	62.6	73.2	81.8	85.8	90.8	95.4	99.7
NO0056R	Hurdal	43.9	56.8	70.2	80.8	86.4	92.1	99.8	99.8
PL0002R	Jarczew	39.0	58.0	80.0	101.0	111.0	124.0	131.0	97.9
PL0003R	Sniezka	74.0	87.0	102.0	117.0	124.0	133.0	140.6	98.8
PL0004R	Leba	58.0	69.0	80.0	91.0	98.0	106.0	115.0	99.9
PL0005R	Diabla Gora	49.0	69.0	85.0	102.0	114.0	127.0	135.0	91.1
RO0008R	Poiana Stampei	34.1	65.8	94.5	113.2	123.5	134.6	142.0	85.4
SE0005R	Bredkälen	42.0	54.0	65.0	76.0	81.0	86.0	92.0	98.8
SE0011R	Vavihill	52.0	67.0	82.0	95.0	104.0	117.4	123.0	98.6
SE0012R	Aspvreten	42.0	60.0	75.0	88.0	95.0	104.0	111.0	99.5
SE0013R	Esrange	58.0	69.0	81.0	93.0	99.0	103.0	105.0	99.3
SE0014R	Råö	57.0	69.0	81.0	91.0	101.0	117.0	127.0	98.7
SE0032R	Norra-Kvill	58.0	70.0	83.0	94.0	102.0	112.0	122.0	99.3
SE0035R	Vindeln	39.0	56.0	73.0	86.0	91.0	96.0	99.0	98.9
SI0008R	Iskrba	18.0	58.0	93.0	116.0	128.0	137.0	141.0	94.9
SI0031R	Zarodnje	69.0	88.0	106.0	123.0	134.3	146.0	151.5	94.6
SI0032R	Krvavec	95.0	107.0	124.0	137.0	145.0	156.0	166.4	92.3
SI0033R	Kovk	67.8	87.0	107.0	126.0	137.0	147.0	153.5	94.4
SK0002R	Chopok	84.0	98.0	110.0	120.0	127.0	134.0	139.0	95.1
SK0004R	Stará Lesná	53.0	73.0	91.0	107.0	116.0	125.0	129.0	99.7
SK0006R	Starina	37.0	56.0	75.0	91.0	99.0	109.0	113.0	99.9
SK0007R	Topolniky	45.0	64.0	85.0	106.0	118.0	133.0	143.0	97.9

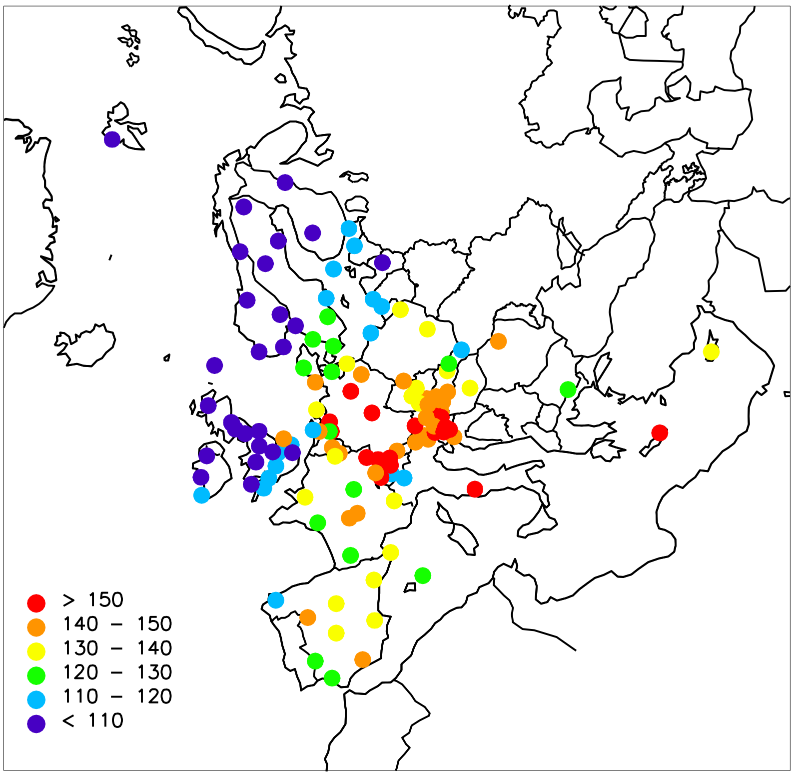


Figure 1.1: Ozone April–September 2010. 99-percentiles (µg/m³).

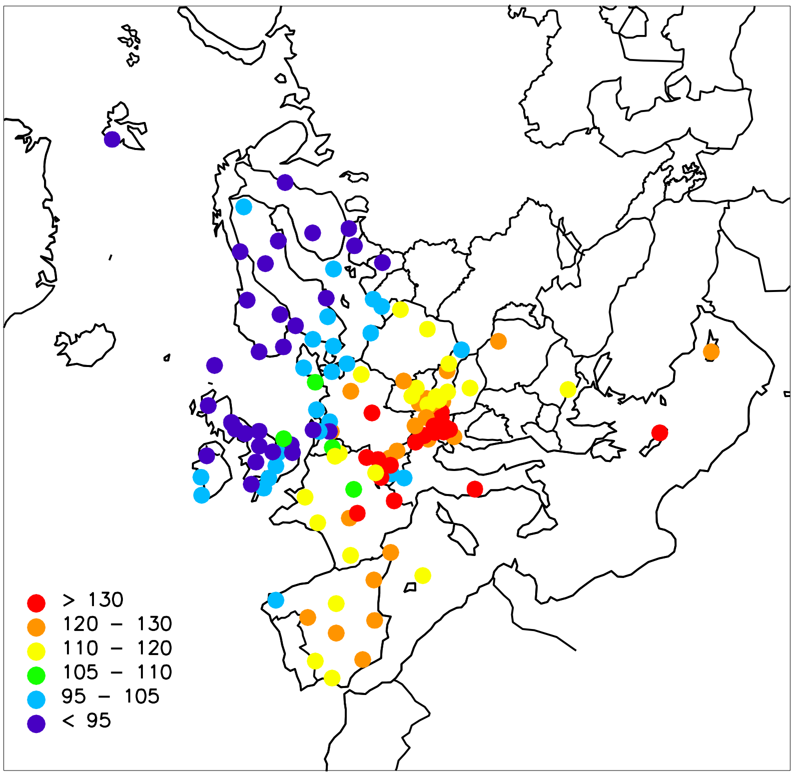


Figure 1.2: Ozone April–September 2010. 95-percentiles (µg/m³).

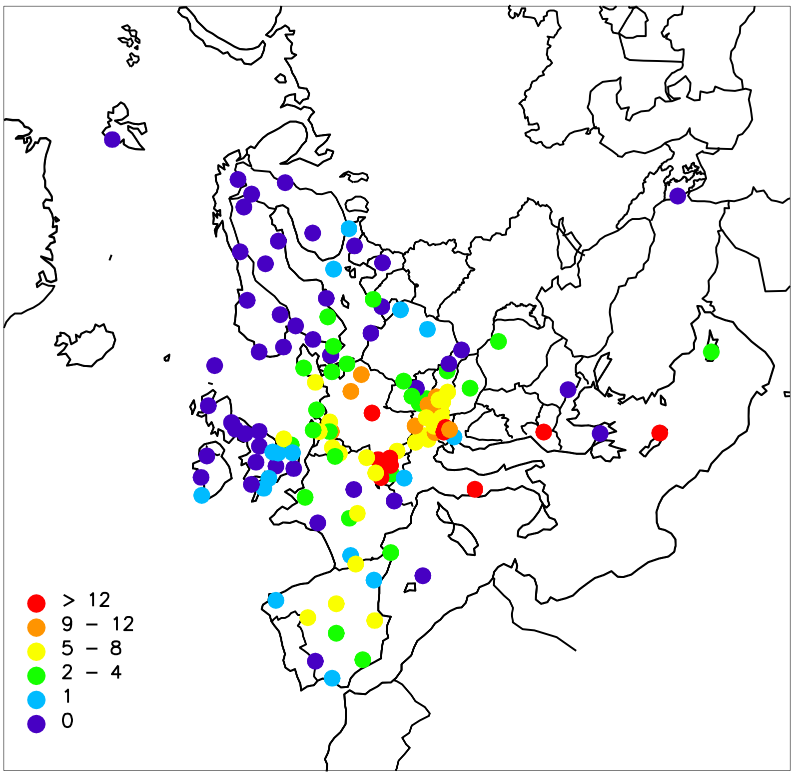


Figure 1.3: *Number of exceedances of the threshold value of 150 μg/m³. (Unit: number of days).*

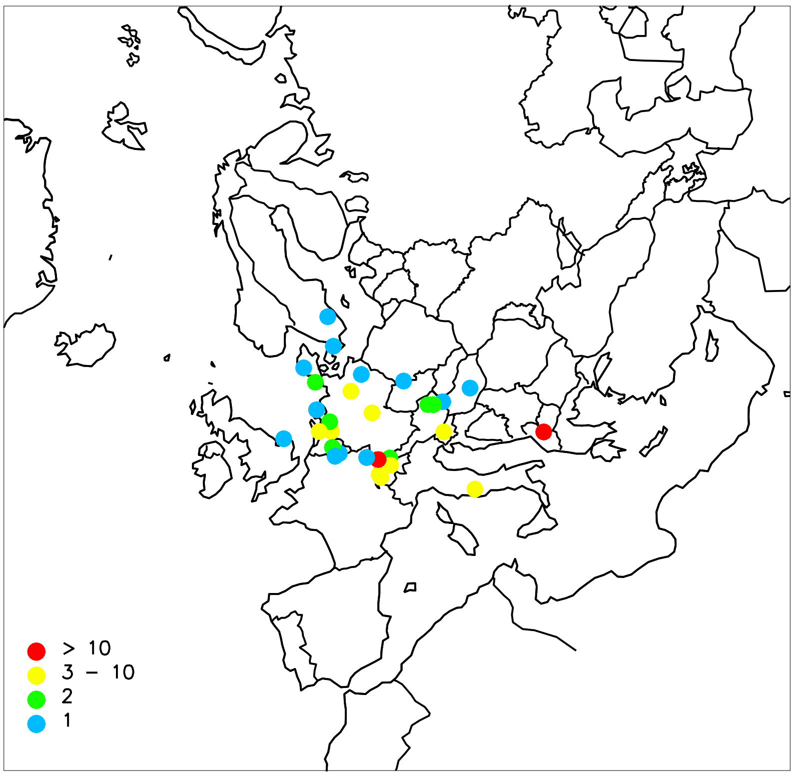


Figure 1.4: *Number of exceedances of the threshold value of 180 μg/m³. (Unit: number of days). Stations with zero exceedances are not shown.*

Annex 2

AOT40 and AOT60, figures and tables

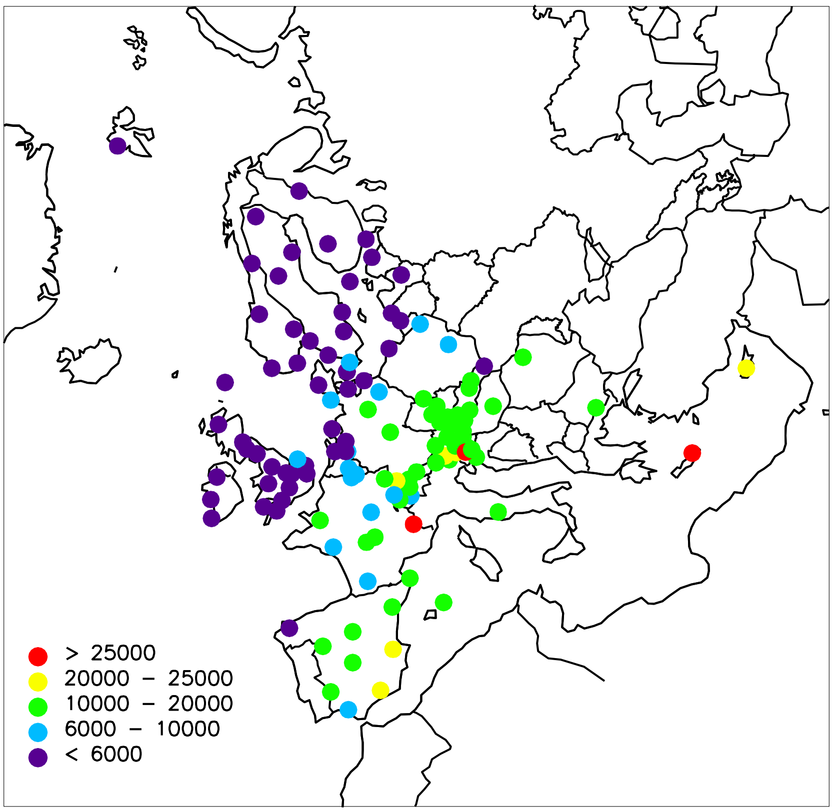


Figure 2.1: AOT40 (ppbh) April–September 2010 (daylight hours).

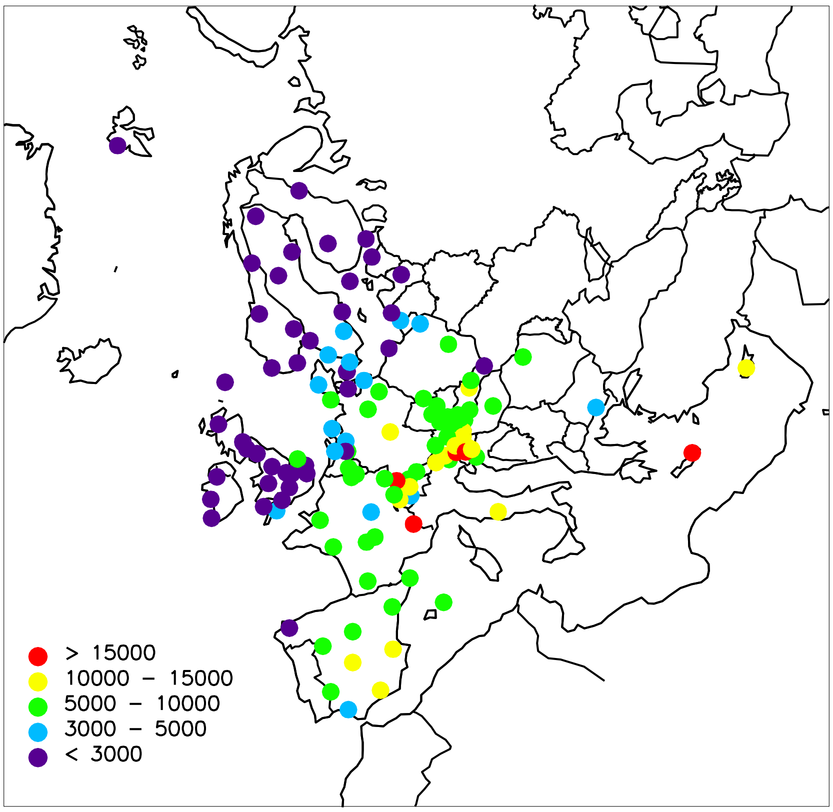


Figure 2.2: AOT40 (ppbh) May, June and July 2010 (daylight hours).

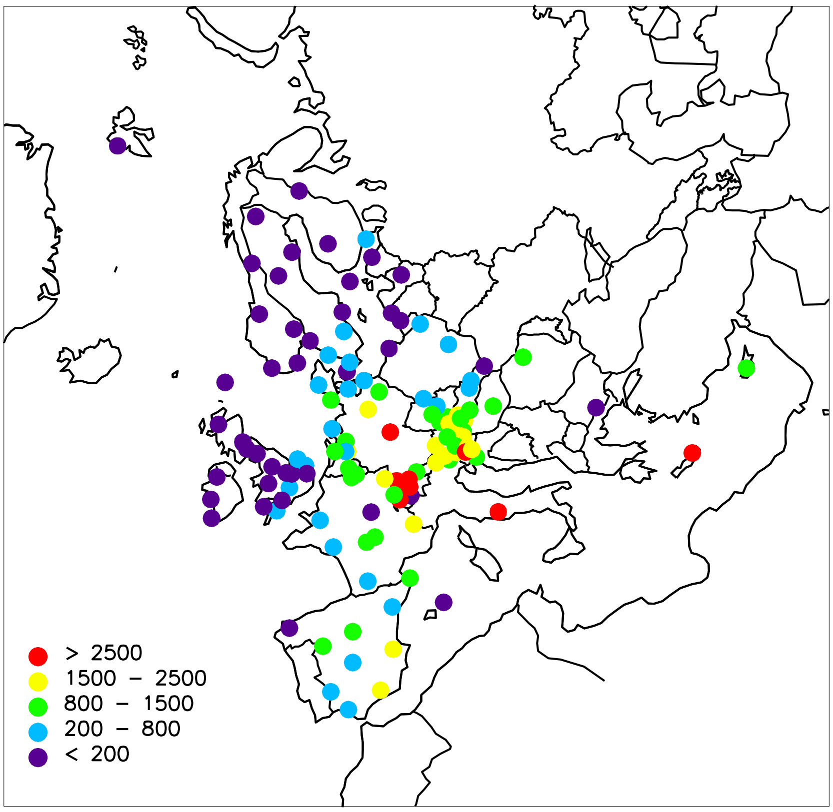


Figure 2.3: AOT60 (ppbh) April-September 2010 (daylight hours).

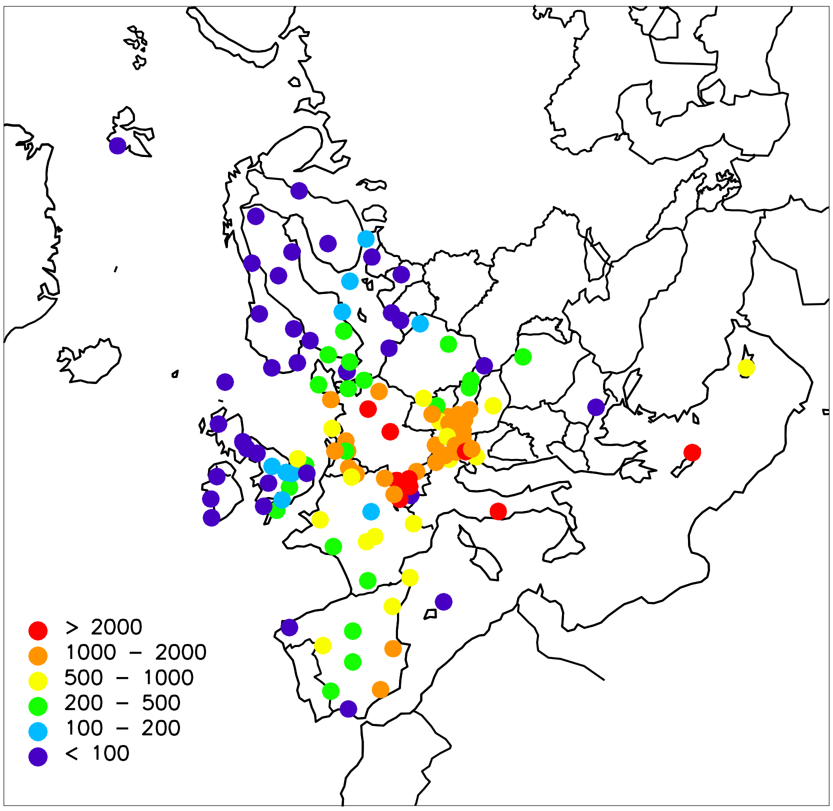


Figure 2.4: AOT60 (ppbh) May, June and July 2010 (daylight hours).

Table 2.1: AOT40 and AOT60 April–September 2010 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT0002R	Illmitz	12200	13505	1672	1850	90
AT0005R	Vorhegg	12331	13788	912	1019	89
AT0030R	Pillersdorf bei Retz	10549	11346	1340	1441	93
AT0032R	Sulzberg	11607	11822	1211	1233	98
AT0034G	Sonnblick	23830	26902	1643	1855	89
AT0037R	Zillertaler Alpen	18108	19009	1646	1727	95
AT0038R	Gerlitzen	23944	25133	2133	2239	95
AT0040R	Masenberg	15571	16698	1474	1581	93
AT0041R	Haunsberg	12622	13262	1663	1747	95
AT0042R	Heidenreichstein	11496	12261	1086	1158	94
AT0043R	Forsthof	12254	12932	1814	1915	95
AT0044R	Graz Platte	16310	18637	2000	2286	88
AT0045R	Dunkelsteinerwald	10381	11016	1548	1643	94
AT0046R	Gänserndorf	11443	12002	1540	1615	95
AT0047R	Stixneusiedl	11084	11625	1470	1542	95
AT0048R	Zoebelboden	11095	11843	884	944	94
AT0049R	Grebenzen bei St. Lamprecht	18776	20459	1300	1417	92
BE0001R	Offagne	8964	9370	1298	1357	96
BE0032R	Eupen	8613	9346	1849	2006	92
BE0035R	Vezin	6889	7258	1328	1400	95
BG0053R	Rojen peak	10268	10614	86	89	97
CH0001G	Jungfraujoch	6415	6617	64	66	97
CH0002R	Payerne	14928	15693	3020	3175	95
CH0003R	Tänikon	13868	14503	3048	3187	96
CH0004R	Chaumont	17911	18867	3609	3801	95
CH0005R	Rigi	16738	17750	3669	3891	94
CY0002R	Ayia Marina	22575	24783	1091	1197	91
CZ0001R	Svratouch	11970	12104	610	617	99
CZ0003R	Košetice	12158	12319	1097	1112	99
DE0001R	Westerland	7493	7882	1038	1092	95
DE0002R	Waldhof	11241	11851	2401	2531	95
DE0003R	Schauinsland	23691	24890	5527	5807	95
DE0007R	Neuglobsow	9995	10955	1227	1345	91
DE0008R	Schmücke	14690	15929	2762	2995	92
DE0009R	Zingst	5329	5551	536	558	96
DK0005R	Keldsnor	3441	3644	367	389	94
DK0012R	Risoe	467	486	8	8	96
DK0031R	Ulborg	4455	4730	349	371	94
DK0041R	Lille Valby	1184	1229	0	0	96
EE0009R	Lahemaa	1213	1227	0	0	99
ES0001R	San Pablo de los Montes	18610	18844	718	727	99
ES0006R	Mahon	12145	12410	122	124	98
ES0007R	Viznar	21165	22090	1762	1839	96
ES0009R	Campisábalos	16220	16735	830	856	97
ES0010R	Cabo de Creus	13923	14041	830	837	99
ES0011R	Barcarrola	11150	11272	412	416	99
ES0012R	Zarra	22033	22066	1537	1539	100
ES0013R	Penausende	16390	16480	1160	1166	99
ES0014R	Els Torms	15889	16215	671	685	98
ES0016R	O Saviñao	5086	5330	100	105	95
ES0017R	Doñana	9767	11114	251	286	88
FI0009R	Utö	3766	3832	127	129	98
FI0017R	Virolahti II	3372	3394	204	206	99
FI0022R	Oulanka	391	393	0	0	99
FI0037R	Ahtari II	1852	1866	17	17	99
FR0008R	Donon	10866	11056	1783	1814	98
FR0009R	Revin	7588	7894	832	866	96
FR0010R	Morvan	6055	6550	175	189	92
FR0013R	Peyrusse Vieille	9110	9155	414	416	100
FR0014R	Montandon	9006	9069	1294	1303	99
FR0015R	La Tardière	8012	8064	418	421	99
FR0016R	Le Casset	26254	27218	2045	2120	96
FR0017R	Montfranc	13266	14168	1250	1336	94
FR0018R	La Coulonche	10142	10724	776	821	95
FR0030R	Puy de Dôme	14425	15732	1411	1539	92

Table 2.1, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
GB0002R	Eskdalemuir	1581	1616	23	24	98
GB0006R	Lough Navar	2018	2031	17	17	99
GB0013R	Yarner Wood	5384	5440	215	217	99
GB0015R	Strath Vaich Dam	1798	1809	0	0	99
GB0031R	Aston Hill	1348	1373	0	0	98
GB0033R	Bush	1661	1679	51	52	99
GB0035R	Great Dun Fell	750	804	0	0	93
GB0036R	Harwell	4246	4296	222	225	99
GB0037R	Ladybower Res.	2906	3105	123	131	94
GB0039R	Sibton	3606	3620	223	224	100
GB0043R	Narberth	2265	2341	10	10	97
GB0045R	Wicken Fen	4123	4169	116	117	99
GB0048R	Auchencorth Moss	1519	1528	44	44	99
GB0049R	Weybourne	8560	9407	626	688	91
GB0050R	St. Osyth	1940	2037	54	57	95
GB0051R	Market Harborough	2655	2691	191	194	99
GB0052R	Lerwick	1241	1246	0	0	100
GB0053R	Charlton Mackrell	4277	4310	145	146	99
GR0002R	Finokalia	41674	43725	8126	8526	95
HU0002R	K-puszta	12076	12226	916	927	99
IE0001R	Valentia Observatory	1357	1399	6	6	97
IE0031R	Mace Head	2999	3003	0	0	100
IT0001R	Montelibretti	17006	18150	3059	3265	94
LT0015R	Preila	5116	5217	120	122	98
LV0010R	Rucava	3019	3052	106	107	99
LV0016R	Zoseni	428	432	0	0	99
NL0007R	Eibergen	5668	5708	1475	1485	99
NL0009R	Kollumerwaard	4940	5074	551	566	97
NL0010R	Vredepeel	2954	2967	319	321	100
NL0011R	Cabauw	5936	5962	1257	1262	100
NO0002R	Birkenes II	3722	3735	1	1	100
NO0015R	Tustervatn	2443	2461	0	0	99
NO0039R	Kårvatn	2791	2795	2	2	100
NO0042G	Zeppelin mountain (Ny-Ålesund)	986	996	0	0	99
NO0043R	Prestebakke	2685	2698	86	86	100
NO0052R	Sandve	1074	1080	0	0	99
NO0056R	Hurdal	1242	1246	0	0	100
PL0002R	Jarczew	9106	9183	542	547	99
PL0003R	Sniezka	11641	11766	576	582	99
PL0004R	Leba	4522	4536	60	60	100
PL0005R	Diabla Gora	8308	9208	610	676	90
RO0008R	Poiana Stampei	10022	11794	803	945	85
SE0005R	Bredkälen	568	580	0	0	98
SE0011R	Vavihill	6388	6562	422	433	97
SE0012R	Aspvreten	3124	3144	114	114	99
SE0013R	Esrange	3018	3063	2	2	99
SE0014R	Råö	4623	4723	238	244	98
SE0032R	Norra-Kvill	5820	5908	430	436	99
SE0035R	Vindeln	2168	2206	50	50	98
SI0008R	Iskrba	13524	14278	1309	1382	95
SI0031R	Zarodnje	16142	16536	2007	2056	98
SI0032R	Krvavec	26430	28472	3640	3921	93
SI0033R	Kovk	16312	17343	2148	2284	94
SK0002R	Chopok	17258	18107	534	561	95
SK0004R	Stará Lesná	11570	11576	399	399	100
SK0006R	Starina	4952	4954	38	38	100
SK0007R	Topolniky	12358	12517	1268	1284	99

Table 2.2: AOT40 and AOT60 May–July 2010 (daylight hours).

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
AT0002R	Illmitz	8379	8987	1464	1571	93
AT0005R	Vorhegg	9032	9966	766	845	91
AT0030R	Pillersdorf bei Retz	6851	7515	1174	1288	91
AT0032R	Sulzberg	8010	8018	1037	1038	100
AT0034G	Sonnblick	14020	16278	1046	1214	86
AT0037R	Zillertaler Alpen	12582	13149	1434	1499	96
AT0038R	Gerlitzen	15695	16449	1716	1798	95
AT0040R	Masenberg	11076	11960	1299	1403	93
AT0041R	Haunsberg	9175	9678	1527	1611	95
AT0042R	Heidenreichstein	7494	7825	914	954	96
AT0043R	Forsthof	8895	9386	1728	1823	95
AT0044R	Graz Platte	11683	12485	1678	1793	94
AT0045R	Dunkelsteinerwald	7108	7550	1418	1506	94
AT0046R	Gänserndorf	7440	7814	1318	1385	95
AT0047R	Stixneusiedl	7616	7978	1339	1403	95
AT0048R	Zoebelboden	7724	8285	717	769	93
AT0049R	Grebenzen bei St. Lamprecht	12652	14216	1144	1286	89
BE0001R	Offagne	7110	7498	1190	1254	95
BE0032R	Eupen	7237	7530	1775	1847	96
BE0035R	Vezin	5628	6068	1282	1383	93
BG0053R	Rojen peak	4704	4902	4	5	96
CH0001G	Jungfraujoch	4324	4465	64	66	97
CH0002R	Payerne	10291	10810	2658	2792	95
CH0003R	Tänikon	9951	10356	2721	2832	96
CH0004R	Chaumont	12062	12658	3100	3253	95
CH0005R	Rigi	11810	12599	3308	3529	94
CY0002R	Ayia Marina	14474	15367	886	941	94
CZ0001R	Svratouch	7213	7238	419	421	100
CZ0003R	Košetice	8100	8297	1043	1068	98
DE0001R	Westerland	5866	6093	1038	1078	96
DE0002R	Waldhof	9044	9508	2307	2425	95
DE0003R	Schauinsland	16243	16982	5018	5247	96
DE0007R	Neuglobsow	7165	7588	1149	1217	94
DE0008R	Schmücke	11116	11714	2632	2773	95
DE0009R	Zingst	4290	4485	498	521	96
DK0005R	Keldsnor	2744	3005	367	402	91
DK0012R	Risoe	151	170	8	9	89
DK0031R	Ulborg	3136	3341	349	372	94
DK0041R	Lille Valby	200	214	0	0	94
EE0009R	Lahemaa	959	960	0	0	100
ES0001R	San Pablo de los Montes	10065	10178	336	340	99
ES0006R	Mahon	6825	6934	83	84	98
ES0007R	Viznar	12763	13792	1298	1403	93
ES0009R	Campisábalos	8247	8507	439	453	97
ES0010R	Cabo de Creus	7678	7750	594	599	99
ES0011R	Barcarrola	6829	6892	327	330	99
ES0012R	Zarra	12797	12822	1277	1279	100
ES0013R	Penausende	8530	8570	542	545	100
ES0014R	Els Torms	9182	9281	541	547	99
ES0016R	O Saviñao	2624	2705	73	75	97
ES0017R	Doñana	4986	5822	66	77	86
FI0009R	Utö	2816	2887	125	128	98
FI0017R	Virolahti II	2578	2598	164	165	99
FI0022R	Oulanka	171	172	0	0	99
FI0037R	Ahtari II	1414	1422	17	17	99
FR0008R	Donon	7891	8119	1486	1529	97
FR0009R	Revin	5628	5973	724	768	94
FR0010R	Morvan	3480	3968	104	119	88
FR0013R	Peyrusse Vieille	5422	5447	360	362	100
FR0014R	Montandon	6526	6543	1190	1193	100
FR0015R	La Tardière	5120	5147	364	365	99
FR0016R	Le Casset	15040	16090	848	907	93
FR0017R	Montfranc	8215	8549	878	913	96
FR0018R	La Coulonche	6294	6939	606	668	91
FR0030R	Puy de Dôme	8010	9217	999	1149	87

Table 2.2, cont.

Code	Station	AOT40	AOT40 corrected	AOT60	AOT60 corrected	Data capture
GB0002R	Eskdalemuir	837	859	23	24	97
GB0006R	Lough Navar	778	781	16	16	100
GB0013R	Yarner Wood	3222	3225	210	210	100
GB0015R	Strath Vaich Dam	756	758	0	0	100
GB0031R	Aston Hill	730	740	0	0	99
GB0033R	Bush	845	849	51	51	100
GB0035R	Great Dun Fell	294	333	0	0	88
GB0036R	Harwell	2814	2819	213	213	100
GB0037R	Ladybower Res.	1857	2049	123	136	91
GB0039R	Sibton	2450	2463	223	224	99
GB0043R	Narberth	962	1015	10	11	95
GB0045R	Wicken Fen	2781	2835	116	118	98
GB0048R	Auchencorth Moss	846	853	44	44	99
GB0049R	Weybourne	5737	5752	585	587	100
GB0050R	St. Osyth	1578	1606	54	55	98
GB0051R	Market Harborough	1930	1947	191	193	99
GB0052R	Lerwick	463	464	0	0	100
GB0053R	Charlton Mackrell	2651	2651	123	123	100
GR0002R	Finokalia	23529	23885	4639	4709	99
HU0002R	K-puszta	7547	7561	762	764	100
IE0001R	Valentia Observatory	612	615	0	0	100
IE0031R	Mace Head	1049	1049	0	0	100
IT0001R	Montelibretti	10136	11397	2302	2588	89
LT0015R	Preila	3274	3324	34	34	99
LV0010R	Rucava	1916	1926	66	66	99
LV0016R	Zoseni	86	86	0	0	99
NL0007R	Eibergen	4958	4990	1458	1467	99
NL0009R	Kollumerwaard	3747	3850	520	535	97
NL0010R	Vredepeel	2597	2597	319	319	100
NL0011R	Cabauw	4962	4984	1246	1252	100
NO0002R	Birkenes II	2365	2373	1	1	100
NO0015R	Tustervatn	906	915	0	0	99
NO0039R	Kårvatn	1195	1197	0	0	100
NO0042G	Zeppelin mountain (Ny-Ålesund)	534	541	0	0	99
NO0043R	Prestebakke	1765	1777	86	86	99
NO0052R	Sandve	661	665	0	0	99
NO0056R	Hurdal	695	698	0	0	100
PL0002R	Jarczew	5255	5274	404	406	100
PL0003R	Sniezka	7670	7670	510	510	100
PL0004R	Leba	2538	2552	30	30	99
PL0005R	Diabla Gora	3700	4242	196	225	87
RO0008R	Poiana Stampei	6303	7174	485	552	88
SE0005R	Bredkälen	307	317	0	0	97
SE0011R	Vavihill	4349	4497	416	431	97
SE0012R	Aspvreten	2378	2386	114	114	100
SE0013R	Esrange	924	947	2	2	98
SE0014R	Råö	3492	3607	236	244	97
SE0032R	Norra-Kvill	3897	3989	426	437	98
SE0035R	Vindeln	1130	1166	50	51	97
SI0008R	Iskrba	9117	9486	968	1007	96
SI0031R	Zarodnje	12208	12662	1871	1941	96
SI0032R	Krvavec	18147	19237	3102	3288	94
SI0033R	Kovk	12123	12694	1836	1922	96
SK0002R	Chopok	10411	10458	472	474	100
SK0004R	Stará Lesná	6154	6154	300	300	100
SK0006R	Starina	2494	2494	34	34	100
SK0007R	Topolniky	8037	8154	1110	1126	99

Annex 3

Seasonal variation

Table 3.1: Monthly mean concentrations 2010 ($\mu g/m^3$).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT0002R	Illmitz	39.9	64.2	68.6	76.1	69.7	80.3	86.8	70.4	54.6	37.4	27.4	31.0
AT0005R	Vorhegg	47.9	72.2	83.0	89.9	85.4	89.3	95.2	71.7	55.0	52.1	50.5	56.5
AT0030R	Pillersdorf bei Retz	40.0	66.3	70.8	79.8	67.6	73.9	92.2	73.1	57.6	41.8	30.9	36.4
AT0032R	Sulzberg	59.0	78.0	82.2	90.4	76.2	90.0	94.7	80.3	72.9	57.6	49.0	53.3
AT0034G	Sonnblick	87.5	94.4	100.9	114.1	108.1	111.4	111.3	100.0	90.5	93.4	80.1	77.3
AT0037R	Zillertaler Alpen	78.7	86.6	90.3	105.7	95.9	105.3	105.9	83.9	72.9	73.8	76.1	-
AT0038R	Gerlitzen	78.3	86.2	92.4	111.8	103.7	108.0	117.9	98.1	83.5	78.2	70.0	62.8
AT0040R	Masenberg	57.7	79.9	83.2	96.6	87.7	92.6	111.2	82.6	66.1	59.6	52.9	59.6
AT0041R	Haunsberg	37.3	67.3	81.9	86.2	72.8	89.6	98.9	79.6	61.1	44.2	38.7	45.3
AT0042R	Heidenreichstein	46.9	67.0	73.0	79.3	67.5	73.6	82.9	68.7	51.5	45.8	35.9	42.5
AT0043R	Forsthof	48.1	66.6	74.4	81.4	71.2	86.2	102.5	82.4	59.6	45.7	38.2	40.4
AT0044R	Graz Platte	44.7	74.4	81.8	97.0	88.8	90.2	111.7	82.3	63.2	-	-	-
AT0045R	Dunkelsteinerwald	38.8	56.5	65.9	71.2	63.6	70.3	81.7	63.4	47.5	32.5	25.8	31.6
AT0046R	Gänserndorf	38.2	64.6	63.4	73.7	64.2	72.6	82.6	69.7	51.3	35.9	26.5	30.7
AT0047R	Stixneusiedl	40.5	66.0	67.0	76.3	65.0	75.1	92.8	74.0	55.0	40.3	30.0	31.8
AT0048R	Zoebelboden	49.9	75.4	85.9	92.9	78.7	89.0	100.4	80.1	62.4	53.0	47.8	56.9
AT0049R	Grebenzen bei St. Lamprecht	76.4	88.5	92.5	107.9	99.5	104.5	113.7	90.7	77.1	73.8	69.5	70.1
BE0001R	Offagne	32.5	52.3	62.9	69.6	61.7	78.3	74.2	50.4	48.1	40.7	37.2	31.9
BE0032R	Eupen	28.5	51.3	53.8	56.6	53.4	71.4	76.0	50.3	44.3	37.2	32.3	27.0
BE0035R	Vezin	23.8	45.1	50.1	55.3	52.5	62.8	60.3	43.2	37.1	32.2	27.4	22.7
BG0053R	Rojen peak	64.4	79.5	87.6	93.3	88.3	80.4	88.8	96.9	79.9	65.7	70.9	63.8
CH0001G	Jungfraujoch	66.7	71.2	73.8	87.0	81.7	86.9	84.3	76.2	69.4	68.0	60.3	62.3
CH0002R	Payerne	33.0	52.9	63.9	78.0	69.5	74.7	84.6	66.7	53.1	33.1	34.3	31.4
CH0003R	Tänikon	31.9	54.0	67.3	72.6	66.4	73.8	81.0	64.5	46.4	30.1	32.5	30.8
CH0004R	Chaumont	58.4	76.6	86.6	101.5	84.6	101.4	109.9	85.7	81.3	64.9	58.6	63.6
CH0005R	Rigi	57.7	77.3	84.3	94.8	82.0	97.1	109.4	85.9	72.7	57.0	51.8	61.0
CY0002R	Ayia Marina	76.3	83.0	90.0	108.9	109.2	98.6	110.5	91.7	87.6	80.7	89.4	75.1
CZ0001R	Svratouch	29.3	53.6	63.6	72.9	67.1	81.3	92.7	84.0	62.5	54.8	42.9	46.3
CZ0003R	Košetice	49.5	71.7	74.2	78.3	66.8	77.4	87.0	67.5	54.8	48.3	35.0	43.7
DE0001R	Westerland	48.1	54.2	69.3	78.5	82.1	79.0	90.6	72.5	61.4	52.4	49.6	50.1
DE0002R	Waldhof	38.0	56.9	63.0	68.2	63.5	72.8	83.8	52.6	49.4	37.6	36.3	38.8
DE0003R	Schauinsland	69.4	77.9	86.9	101.3	91.4	113.4	120.7	95.4	90.8	75.4	64.2	68.4
DE0007R	Neuglobsow	44.2	58.4	65.1	74.5	66.2	69.9	83.1	56.4	42.3	34.7	34.6	42.2
DE0008R	Schmücke	47.7	66.0	74.1	89.5	75.0	98.9	110.9	80.0	65.6	54.6	48.1	49.2
DE0009R	Zingst	53.3	63.5	65.5	71.0	68.5	66.2	83.2	62.9	56.5	45.1	45.0	49.6

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DK0005R	Keldsnor	51.0	56.6	65.1	73.0	66.5	61.3	80.0	60.8	57.4	48.8	48.6	51.5
DK0012R	Risoe	-	-	-	-	-	-	42.8	64.0	55.6	45.5	44.0	45.9
DK0031R	Ulborg	56.4	54.9	69.7	77.2	74.0	71.3	79.6	63.1	60.8	48.9	49.0	45.8
DK0041R	Lille Valby	49.1	57.7	66.7	75.1	67.8	-	-	-	-	-	-	-
EE0009R	Lahemaa	50.0	50.4	38.2	27.7	28.9	41.3	67.8	55.6	44.8	44.7	42.5	45.2
ES0001R	San Pablo de los Montes	51.1	78.2	82.1	92.6	90.3	93.0	104.9	98.7	93.1	85.0	69.1	63.5
ES0006R	Mahon	67.0	75.8	84.3	93.6	84.1	83.6	85.2	82.4	80.6	77.9	64.4	62.9
ES0007R	Viznar	68.0	71.5	76.6	85.8	94.5	98.4	106.1	100.3	88.5	79.5	65.4	65.9
ES0009R	Campisábalos	65.9	73.4	77.9	87.1	83.0	78.0	83.3	84.1	72.2	72.3	61.8	61.3
ES0010R	Cabo de Creus	76.0	28.8	66.2	99.3	86.7	90.6	85.3	82.5	81.5	67.9	57.4	54.0
ES0011R	Barcarrola	55.9	57.6	61.0	66.1	65.6	80.0	81.3	74.8	68.6	56.5	46.7	50.0
ES0012R	Zarra	65.2	75.3	82.9	98.1	94.2	96.2	104.5	92.4	89.5	81.4	67.2	62.9
ES0013R	Penausende	63.8	71.6	79.3	89.7	85.6	82.9	86.8	88.6	83.5	75.4	61.5	58.8
ES0014R	Els Torms	65.3	70.6	82.5	89.3	86.4	85.5	92.5	84.8	79.0	70.0	55.5	48.2
ES0016R	O Saviñao	58.1	69.2	74.6	78.4	70.8	65.5	52.4	53.6	56.3	47.1	42.8	40.1
ES0017R	Doñana	48.4	59.5	64.0	73.5	73.0	78.1	69.4	70.2	61.7	57.9	46.9	44.2
FI0009R	Utö	59.3	60.4	71.9	70.7	68.9	67.0	80.0	70.1	62.7	60.5	51.0	55.9
FI0017R	Virolahti II	39.1	47.0	59.7	55.7	57.6	54.3	64.6	56.2	43.8	46.2	43.3	40.2
FI0022R	Oulanka	-	-	82.1	74.0	62.0	54.9	52.1	45.6	46.5	53.4	56.2	60.2
FI0037R	Ahtari II	49.6	56.3	71.4	68.5	60.8	53.9	62.6	47.6	41.8	47.0	49.2	46.7
FI0096G	Pallas (Sammaltunturi)	68.4	68.5	-	-	-	-	-	-	-	-	-	-
FR0008R	Donon	41.7	64.5	73.6	84.6	68.0	86.6	89.4	68.7	58.9	49.6	48.6	46.1
FR0009R	Revin	32.2	55.5	65.9	74.9	62.6	74.2	78.2	56.2	50.6	41.6	36.6	34.7
FR0010R	Morvan	54.4	70.1	73.4	79.2	68.8	69.6	66.4	52.6	53.8	56.1	54.2	54.5
FR0013R	Peyrusse Vieille	50.7	65.3	72.0	83.8	72.4	78.4	69.3	65.9	73.0	62.0	54.7	47.0
FR0014R	Montandon	36.7	59.2	65.9	71.3	55.4	66.8	76.4	59.3	54.1	44.2	44.9	38.1
FR0015R	La Tardière	39.3	56.0	61.0	72.7	69.3	70.1	59.7	53.1	65.3	51.5	43.2	38.9
FR0016R	Le Casset	87.2	92.3	98.5	121.2	104.0	106.0	108.3	95.7	85.8	78.3	75.2	79.5
FR0017R	Montfranc	60.8	76.8	87.5	97.3	86.0	90.8	85.7	73.3	78.8	67.5	59.5	59.6
FR0018R	La Coulonche	50.7	68.9	76.2	87.6	83.9	82.3	72.7	59.9	73.2	61.2	56.3	48.4
FR0019R	Pic du Midi	90.5	96.0	97.1	108.7	97.9	-	112.6	108.7	92.2	94.7	86.6	87.6
FR0030R	Puy de Dôme	78.4	75.9	89.7	102.8	89.0	101.2	93.1	81.9	89.4	80.0	71.0	70.3

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB0002R	Eskdalemuir	61.5	64.1	61.3	65.9	60.6	58.3	45.9	45.0	50.8	49.6	49.9	47.0
GB0006R	Lough Navar	44.9	46.3	57.5	64.8	59.3	51.2	42.5	39.8	47.9	41.2	42.7	36.7
GB0013R	Yarner Wood	57.0	62.3	72.5	81.8	74.4	72.8	50.4	50.3	52.8	50.4	47.9	46.8
GB0014R	High Muffles	50.3	56.8	65.8	77.0	73.5	68.9	55.0	56.0	57.2	51.5	53.2	55.1
GB0015R	Strath Vaich Dam	67.8	76.2	79.6	76.6	70.7	61.7	54.2	47.2	42.6	65.1	50.5	44.1
GB0031R	Aston Hill	50.7	54.6	65.1	74.5	63.9	62.2	45.1	51.5	57.1	50.7	49.8	48.7
GB0033R	Bush	54.0	49.5	64.3	74.4	66.6	60.7	50.6	47.7	54.4	54.3	54.0	48.7
GB0035R	Great Dun Fell	47.0	-	70.6	77.9	70.1	59.6	44.1	49.8	56.7	55.8	55.1	63.6
GB0036R	Harwell	38.2	49.6	63.1	73.3	64.7	67.4	54.5	51.3	51.7	47.5	37.5	30.5
GB0037R	Ladybower Res.	47.9	51.7	66.5	74.7	67.3	66.7	52.4	52.1	58.0	51.1	52.4	53.8
GB0038R	Lullington Heath	37.5	-	-	-	-	-	-	-	-	41.1	34.3	26.0
GB0039R	Sibton	36.3	51.3	59.8	68.6	67.1	64.9	53.0	51.1	52.2	48.7	45.8	38.0
GB0043R	Narberth	55.0	59.6	72.5	80.5	68.3	62.3	43.3	48.1	54.3	52.8	54.1	50.9
GB0045R	Wicken Fen	29.5	44.1	53.0	61.0	59.2	58.1	48.3	42.3	42.0	36.7	32.5	25.1
GB0048R	Auchencorth Moss	54.3	51.5	61.2	70.7	64.4	61.1	49.0	47.5	55.0	53.3	53.8	51.9
GB0049R	Weybourne	52.2	64.0	76.5	87.7	86.3	81.9	67.0	62.4	60.0	62.6	59.6	51.5
GB0050R	St. Osyth	30.7	41.5	53.1	61.0	61.2	60.7	54.1	46.8	44.3	45.5	39.1	33.2
GB0051R	Market Harborough	36.0	47.0	60.2	70.1	65.2	62.6	48.7	42.6	37.5	36.1	29.1	23.8
GB0052R	Lerwick	65.6	70.7	79.2	80.0	69.8	64.2	51.5	40.7	65.3	63.7	64.3	69.0
GB0053R	Charlton Mackrell	41.8	56.6	65.0	75.4	65.9	68.1	52.7	51.9	54.2	49.8	43.3	37.4
GR0001R	Aliartos	54.3	-	-	-	72.2	74.0	71.6	59.1	44.3	-	64.6	41.6
GR0002R	Finokalia	87.8	94.0	108.0	117.4	123.5	111.8	128.6	120.5	121.3	97.8	86.0	83.6
HU0002R	K-puszta	30.2	48.5	59.7	71.6	69.2	64.3	70.3	61.7	39.9	37.7	36.6	35.9
IE0001R	Valentia Observatory	52.1	61.4	68.2	74.5	66.6	57.3	49.6	56.5	69.6	65.8	72.0	69.3
IE0031R	Mace Head	67.7	73.0	79.9	87.7	75.8	64.8	57.2	60.8	71.5	69.0	69.8	65.1
IT0001R	Montelibretti	26.9	39.3	48.2	52.5	56.0	61.9	74.4	63.7	59.8	38.8	30.1	31.3
IT0004R	Ispra	7.0	16.8	31.8	40.2	41.3	45.8	65.1	63.9	52.4	52.1	24.1	5.8
LT0015R	Preila	50.6	64.8	73.7	74.1	67.7	71.1	74.2	72.4	54.1	52.6	43.4	50.1
LV0010R	Rucava	-	-	72.0	72.5	62.7	59.6	60.0	56.6	47.3	44.2	38.5	35.6
LV0016R	Zoseni	60.7	67.2	73.9	68.5	55.6	46.0	41.5	43.8	42.8	46.5	40.9	48.4
MK0007R	Lazaropole	35.2	-	133.7	133.5	138.1	121.1	129.1	145.9	117.2	102.3	110.3	91.3

Table 3.1, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NL0007R	Eibergen	20.5	33.6	45.0	55.0	50.2	59.6	62.4	35.5	29.4	23.7	25.0	21.8
NL0009R	Kollumerwaard	33.1	43.1	59.5	71.4	74.5	66.2	65.3	44.0	43.3	37.4	32.1	33.4
NL0010R	Vredepeel	18.7	34.1	44.8	49.1	46.0	49.2	49.7	34.2	27.1	21.6	21.8	19.8
NL0011R	Cabauw	18.9	36.1	48.1	60.2	58.8	62.1	56.2	36.9	30.5	23.3	21.7	19.9
NL0091R	De Zilk	23.7	33.4	45.8	53.2	61.1	55.6	43.5	45.1	45.5	37.2	29.1	30.4
NO0002R	Birkenes II	66.8	65.4	78.7	78.2	69.8	68.4	62.1	57.2	56.3	48.0	52.1	57.5
NO0015R	Tustervatn	74.6	75.2	86.6	88.4	76.2	60.1	48.5	45.2	50.9	62.8	64.4	63.4
NO0039R	Kårvatn	66.7	69.5	78.0	75.4	63.7	50.9	44.5	35.8	30.4	45.4	55.6	55.4
NO0042G	Zeppelin mountain (Ny-Ålesund)	77.2	82.1	81.0	76.0	73.5	61.6	52.9	52.9	63.9	69.8	74.2	74.0
NO0043R	Prestebakke	57.2	56.8	68.6	72.3	62.8	64.1	63.7	51.5	45.9	46.0	49.5	45.4
NO0052R	Sandve	60.5	62.3	70.3	73.3	66.8	62.8	59.4	50.7	57.9	54.6	55.2	55.1
NO0055R	Karasjok	68.8	69.7	-	-	-	-	-	-	-	-	-	-
NO0056R	Hurdal	54.3	55.3	63.4	69.8	63.1	62.7	56.2	44.0	43.1	44.2	52.9	50.9
PL0002R	Jarczew	48.6	66.7	70.1	71.8	57.8	66.3	64.4	60.8	43.0	44.2	36.3	38.2
PL0003R	Sniezka	67.9	83.3	83.4	97.2	85.9	90.3	102.1	85.5	69.4	54.2	29.8	63.7
PL0004R	Leba	51.4	66.5	72.0	76.9	68.1	68.4	73.7	67.0	59.6	46.8	38.4	49.8
PL0005R	Diabla Gora	53.2	68.7	74.0	76.7	65.1	68.3	67.4	68.9	59.4	50.1	41.8	49.8
RO0008R	Poiana Stampei	47.8	40.3	65.9	69.3	76.3	66.8	65.3	65.6	52.4	45.6	52.2	50.4
SE0005R	Bredkälen	61.6	61.2	72.4	68.7	59.3	46.6	54.0	45.0	49.2	54.8	69.1	71.4
SE0011R	Vavihill	59.7	62.8	69.1	82.1	69.6	67.6	79.1	55.3	50.0	41.1	45.1	59.7
SE0012R	Aspvreten	53.3	56.5	70.7	66.6	63.6	58.8	67.8	50.0	43.6	44.5	41.6	44.2
SE0013R	Esrange	71.8	75.1	91.0	92.0	77.8	68.5	57.8	59.0	62.8	68.1	73.9	73.6
SE0014R	Råö	55.3	54.8	64.0	73.4	66.8	69.8	80.8	63.9	57.9	52.9	55.2	49.9
SE0032R	Norra-Kvill	60.6	65.1	79.0	83.4	71.3	72.7	78.9	62.6	57.1	50.4	52.8	55.9
SE0035R	Vindeln	57.2	60.1	80.3	78.3	67.8	58.4	50.6	39.3	33.5	44.9	51.4	54.8
SI0008R	Iskrba	45.0	61.7	70.6	72.8	73.0	60.4	60.9	45.1	35.5	40.0	37.4	-
SI0031R	Zarodnje	45.6	74.1	79.0	90.3	92.3	93.2	110.4	81.3	61.1	53.9	44.9	47.8
SI0032R	Krvavec	83.3	94.9	100.7	113.6	110.2	118.9	121.0	102.7	85.8	80.7	75.7	74.4
SI0033R	Kovk	47.8	63.1	74.9	92.3	91.5	89.5	106.8	78.9	62.8	59.3	44.2	42.1
SK0002R	Chopok	75.8	88.0	90.9	103.4	101.2	92.3	105.8	100.4	72.0	74.0	67.8	77.2
SK0004R	Stará Lesná	51.7	72.3	83.3	88.2	71.1	76.5	74.6	69.0	53.6	57.1	58.4	56.5
SK0006R	Starina	29.6	42.2	70.5	73.5	57.5	58.7	57.1	56.2	39.1	42.6	46.1	48.2
SK0007R	Topolniky	43.6	65.2	65.0	74.7	69.3	73.2	77.8	62.7	38.3	32.6	31.9	30.5

Table 3.2: Monthly data capture 2010 (μg/m³).

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT0002R	Illmitz	95	95	94	94	94	95	94	86	94	95	94	94
AT0005R	Vorhegg	95	96	96	81	95	95	84	92	95	97	95	54
AT0030R	Pillersdorf bei Retz	96	95	96	96	88	94	95	95	95	95	89	96
AT0032R	Sulzberg	94	96	96	96	96	96	96	86	96	95	96	96
AT0034G	Sonnblick	95	96	66	96	96	96	65	94	92	90	94	93
AT0037R	Zillertaler Alpen	97	96	96	94	88	96	96	88	96	96	31	0
AT0038R	Gerlitzen	96	96	96	98	99	96	96	96	95	96	96	96
AT0040R	Masenberg	94	83	94	93	90	94	95	95	96	95	96	96
AT0041R	Haunsberg	94	96	95	96	96	96	95	95	96	92	96	96
AT0042R	Heidenreichstein	96	96	94	86	95	94	94	95	95	92	95	95
AT0043R	Forsthof	95	95	93	95	94	92	94	95	96	91	94	95
AT0044R	Graz Platte	96	96	96	96	95	88	96	96	45	0	0	0
AT0045R	Dunkelsteinerwald	96	95	93	95	91	94	94	95	95	91	94	95
AT0046R	Gänserndorf	96	95	94	96	95	93	94	96	96	91	95	96
AT0047R	Stixneusiedl	96	95	94	95	95	94	94	95	96	91	95	96
AT0048R	Zoebelboden	91	95	77	95	96	94	95	95	94	95	82	79
AT0049R	Grebenzen bei St. Lamprecht	95	95	96	96	83	95	95	91	95	96	96	96
BE0001R	Offagne	98	82	98	97	98	98	89	97	98	84	98	98
BE0032R	Eupen	97	83	97	81	98	97	93	90	94	83	98	97
BE0035R	Vezin	87	85	98	97	98	98	85	98	98	97	84	97
BG0053R	Rojen peak	95	90	92	94	94	92	94	95	94	95	95	93
CH0001G	Jungfraujoch	98	97	98	97	97	97	97	97	97	98	95	96
CH0002R	Payerne	95	96	95	95	96	95	95	95	95	95	95	95
CH0003R	Tänikon	96	95	95	95	96	96	95	95	96	96	95	96
CH0004R	Chaumont	96	96	95	95	95	95	96	95	95	95	95	95
CH0005R	Rigi	96	96	95	95	96	96	90	95	96	95	95	96
CY0002R	Ayia Marina	100	97	97	77	99	94	94	93	100	90	99	92
CZ0001R	Svratouch	100	75	96	99	99	100	100	94	100	99	100	100
CZ0003R	Košetice	100	95	100	100	100	93	100	100	100	100	100	100
DE0001R	Westerland	96	96	91	96	96	96	96	94	94	92	92	94
DE0002R	Waldhof	96	96	90	96	96	95	96	94	96	95	95	96
DE0003R	Schauinsland	96	96	96	96	95	96	96	96	85	95	96	96
DE0007R	Neuglobsow	96	95	95	94	95	95	96	96	84	94	96	95
DE0008R	Schmücke	96	92	94	79	96	96	95	93	96	96	94	96
DE0009R	Zingst	96	96	94	96	96	96	96	96	96	96	96	95

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DK0005R	Keldsnor	86	91	91	92	81	91	88	91	92	90	92	91
DK0012R	Risoe	0	0	0	0	0	0	22	92	90	92	92	87
DK0031R	Ulborg	92	92	91	92	92	92	83	82	91	92	82	92
DK0041R	Lille Valby	91	92	92	92	51	0	0	0	0	0	0	0
EE0009R	Lahemaa	100	100	100	100	100	100	100	97	100	100	99	100
ES0001R	San Pablo de los Montes	99	100	100	99	99	99	100	99	99	99	100	99
ES0006R	Mahon	97	94	99	90	99	100	97	100	99	99	99	99
ES0007R	Viznar	100	99	93	99	98	88	82	100	99	99	99	98
ES0009R	Campisábalos	99	99	99	97	97	91	99	98	97	100	99	98
ES0010R	Cabo de Creus	100	100	76	100	100	99	100	100	100	86	99	99
ES0011R	Barcarrola	100	99	99	99	98	100	99	99	99	99	99	97
ES0012R	Zarra	59	100	100	100	100	100	99	99	99	99	99	99
ES0013R	Penausende	100	98	100	100	100	99	100	100	99	99	99	100
ES0014R	Els Torms	99	96	97	95	99	100	100	99	100	100	99	99
ES0016R	O Saviñao	99	100	97	94	98	99	93	88	97	86	97	99
ES0017R	Doñana	99	99	96	99	99	95	59	88	89	99	90	89
FI0009R	Utö	99	97	99	100	96	99	98	99	100	100	99	56
FI0017R	Virolahti II	94	99	99	98	97	98	99	98	98	98	99	99
FI0022R	Oulanka	0	0	93	98	96	99	99	99	98	99	66	100
FI0037R	Ahtari II	98	99	99	99	99	100	100	98	99	96	100	100
FI0096G	Pallas (Sammaltunturi)	98	96	0	0	0	0	0	0	0	0	0	0
FR0008R	Donon	100	100	99	100	100	100	93	100	100	98	100	100
FR0009R	Revin	100	100	99	97	98	100	87	99	99	100	100	100
FR0010R	Morvan	99	98	96	95	97	95	69	98	99	99	97	93
FR0013R	Peyrusse Vieille	100	100	100	100	99	100	100	98	100	99	100	100
FR0014R	Montandon	100	99	100	99	100	100	100	100	99	100	99	82
FR0015R	La Tardière	100	99	100	100	99	99	100	99	100	100	99	99
FR0016R	Le Casset	100	96	100	100	100	80	100	100	100	100	100	99
FR0017R	Montfranc	100	99	99	85	92	97	98	99	85	98	99	96
FR0018R	La Coulonche	97	99	100	100	78	98	99	100	100	100	100	98
FR0019R	Pic du Midi	100	96	98	98	87	0	55	20	97	62	80	99
FR0030R	Puy de Dôme	97	79	15	97	87	87	88	99	99	95	98	87

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB0002R	Eskdalemuir	100	95	100	100	100	100	92	96	100	100	100	100
GB0006R	Lough Navar	100	99	100	100	100	100	100	99	99	100	99	100
GB0013R	Yarner Wood	99	96	100	100	100	100	100	96	100	100	100	100
GB0014R	High Muffles	100	100	96	100	100	100	35	81	100	99	100	100
GB0015R	Strath Vaich Dam	93	99	100	100	100	100	100	99	99	99	100	100
GB0031R	Aston Hill	99	96	100	100	100	98	100	96	99	100	99	100
GB0033R	Bush	96	100	100	100	100	100	100	99	99	100	100	100
GB0035R	Great Dun Fell	84	0	21	100	99	67	97	97	96	97	98	97
GB0036R	Harwell	99	96	100	100	100	100	100	99	95	100	100	100
GB0037R	Ladybower Res.	100	100	95	100	100	99	72	95	100	99	72	100
GB0038R	Lullington Heath	77	0	0	0	0	0	0	0	0	57	100	100
GB0039R	Sibton	99	100	100	100	100	100	99	100	100	100	100	100
GB0043R	Narberth	85	95	100	99	100	100	86	100	98	100	96	100
GB0045R	Wicken Fen	96	99	99	100	100	100	95	99	99	99	99	100
GB0048R	Auchencorth Moss	100	99	99	100	100	100	99	100	100	100	100	100
GB0049R	Weybourne	99	91	98	100	100	100	100	61	82	99	100	100
GB0050R	St. Osyth	99	99	92	83	100	99	97	95	100	100	100	100
GB0051R	Market Harborough	99	96	100	99	100	99	99	97	100	99	99	100
GB0052R	Lerwick	100	100	99	100	100	100	100	99	100	100	100	100
GB0053R	Charlton Mackrell	100	100	94	100	100	100	100	96	100	100	100	99
GR0001R	Aliartos	98	0	0	0	43	83	80	88	93	0	30	68
GR0002R	Finokalia	66	85	93	100	98	98	99	79	100	98	99	87
HU0002R	K-puszta	100	100	66	97	100	100	100	99	94	100	100	100
IE0001R	Valentia Observatory	98	93	100	100	100	100	100	84	100	99	100	99
IE0031R	Mace Head	100	100	100	100	100	100	100	100	100	100	100	100
IT0001R	Montelibretti	100	100	99	97	67	99	100	100	100	100	100	100
IT0004R	Ispra	77	70	93	100	67	48	97	88	90	100	99	100
LT0015R	Preila	100	100	99	100	99	100	97	99	92	93	96	100
LV0010R	Rucava	0	0	55	100	100	100	99	99	96	100	98	83
LV0016R	Zoseni	100	43	100	100	99	100	100	97	100	100	100	100
MK0007R	Lazaropole	95	0	35	20	33	73	35	65	89	56	45	21

Table 3.2, cont.

Code	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NL0007R	Eibergen	100	100	100	100	100	100	99	100	99	92	100	98
NL0009R	Kollumerwaard	87	99	97	96	89	96	95	98	100	100	99	95
NL0010R	Vredepeel	86	98	98	98	99	100	98	98	99	99	84	98
NL0011R	Cabauw	97	100	100	100	100	100	99	99	100	96	92	88
NL0091R	De Zilk	98	98	92	97	71	79	89	95	56	65	97	92
NO0002R	Birkenes II	100	100	100	100	100	100	100	100	100	64	71	99
NO0015R	Tustervatn	100	100	99	100	99	100	99	100	100	99	100	99
NO0039R	Kårvatn	99	100	99	100	100	100	98	100	99	99	100	99
NO0042G	Zeppelin mountain (Ny-Ålesund)	98	100	97	100	99	100	98	100	100	99	99	99
NO0043R	Prestebakke	100	100	100	100	100	100	99	100	100	99	100	100
NO0052R	Sandve	100	98	100	100	100	99	100	100	100	100	100	99
NO0055R	Karasjok	100	100	0	0	0	0	0	0	0	0	0	0
NO0056R	Hurdal	99	100	99	100	100	100	100	100	100	100	100	100
PL0002R	Jarczew	93	89	100	100	97	98	99	97	97	99	99	100
PL0003R	Sniezka	100	100	100	100	100	100	100	94	99	100	51	31
PL0004R	Leba	100	100	100	100	100	99	100	100	100	100	100	100
PL0005R	Diabla Gora	100	100	100	84	100	61	100	100	100	45	100	100
RO0008R	Poiana Stampei	82	97	95	97	92	76	96	61	90	33	93	98
SE0005R	Bredkälen	99	100	100	100	100	96	97	100	100	100	100	100
SE0011R	Vavihill	100	99	99	100	100	95	99	99	98	97	100	100
SE0012R	Aspvreten	100	84	89	98	99	100	100	100	100	100	100	76
SE0013R	Esrange	99	100	100	100	100	96	100	100	100	100	99	100
SE0014R	Råö	100	99	100	100	100	93	100	100	99	99	100	100
SE0032R	Norra-Kvill	98	97	99	100	99	97	100	100	99	100	97	96
SE0035R	Vindeln	97	100	100	100	99	96	98	100	100	98	100	97
SI0008R	Iskrba	95	94	95	95	96	96	96	94	93	96	94	0
SI0031R	Zarodnje	95	96	96	96	96	94	93	95	94	89	94	95
SI0032R	Krvavec	87	96	96	95	94	95	95	92	82	81	91	92
SI0033R	Kovk	92	95	95	90	96	96	96	94	96	95	95	96
SK0002R	Chopok	98	100	100	100	99	99	100	95	77	100	100	99
SK0004R	Stará Lesná	98	99	100	99	100	100	100	100	100	99	100	99
SK0006R	Starina	98	100	100	100	100	100	100	100	100	100	100	100
SK0007R	Topolniky	98	99	93	98	100	99	95	99	96	94	97	97

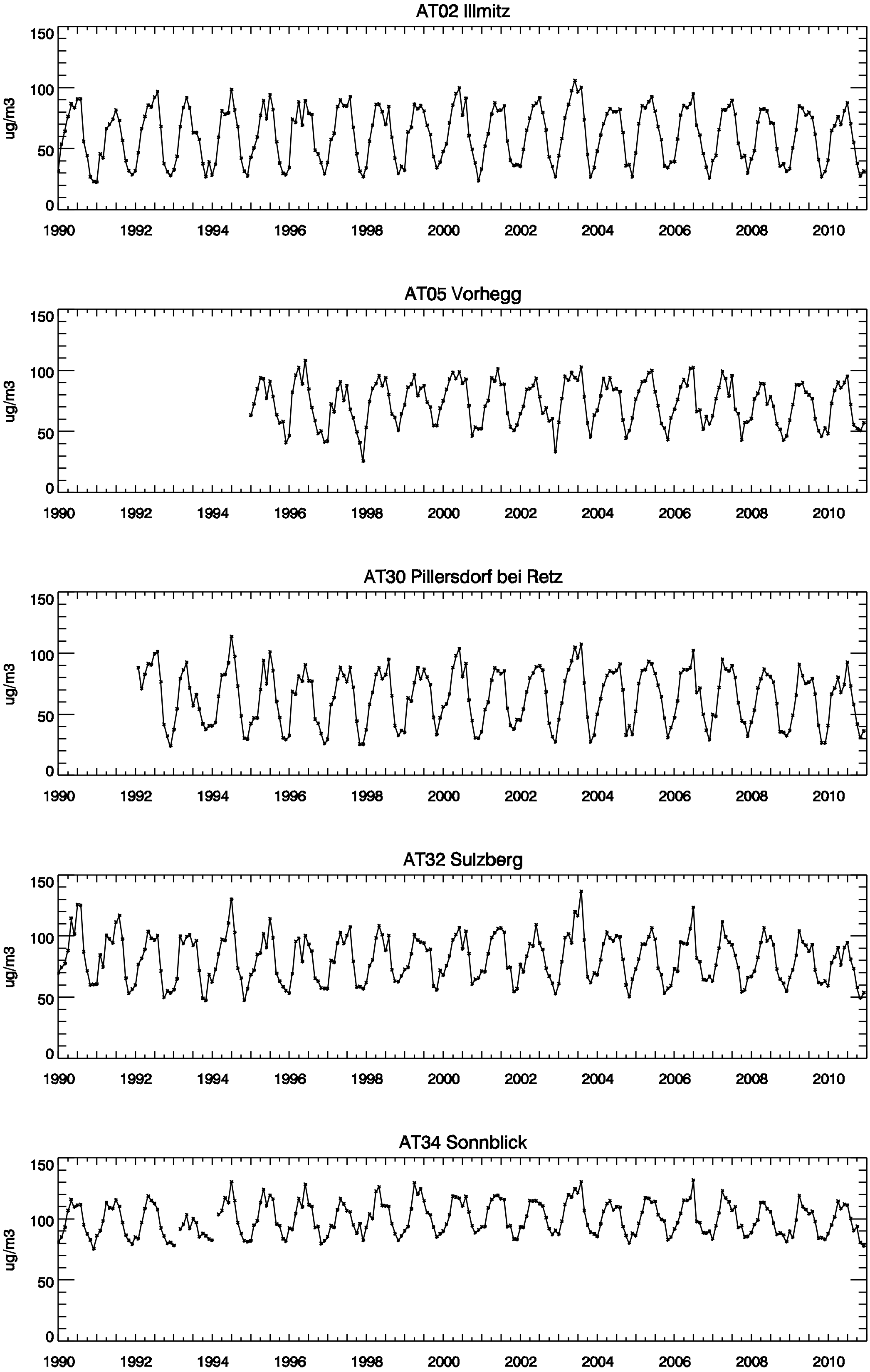
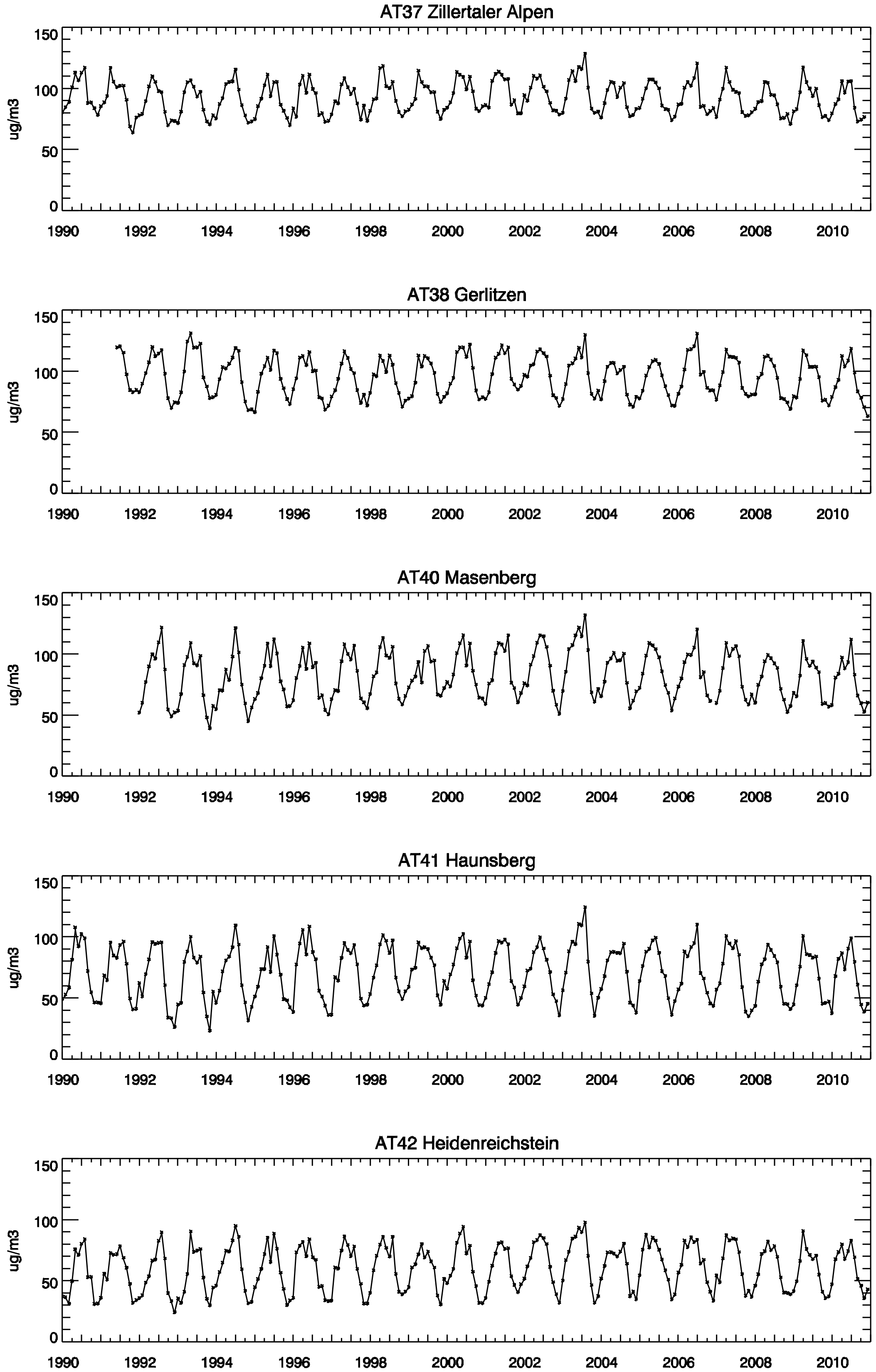


Figure 3.1: Seasonal variation, 1990–2010.



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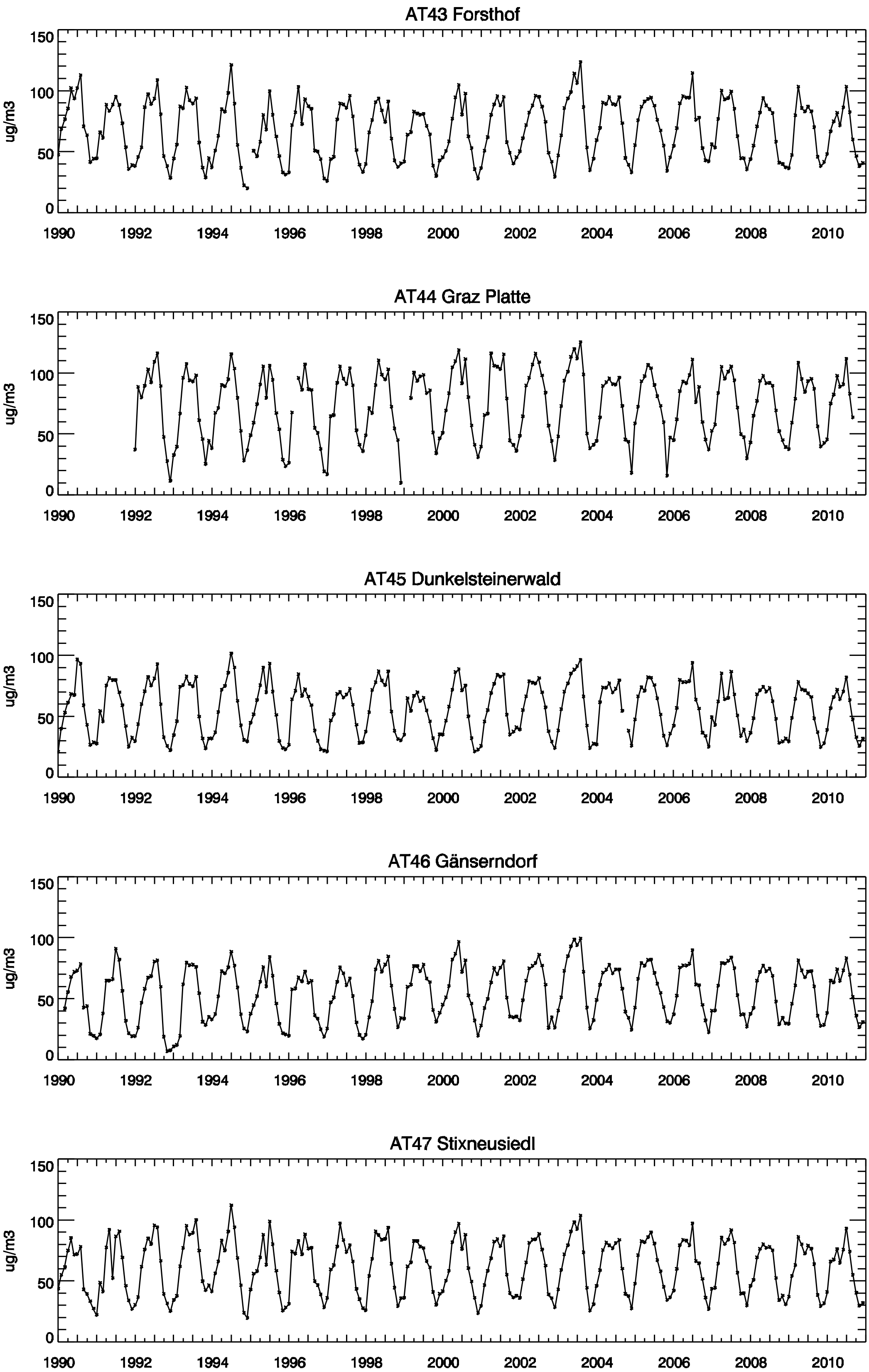

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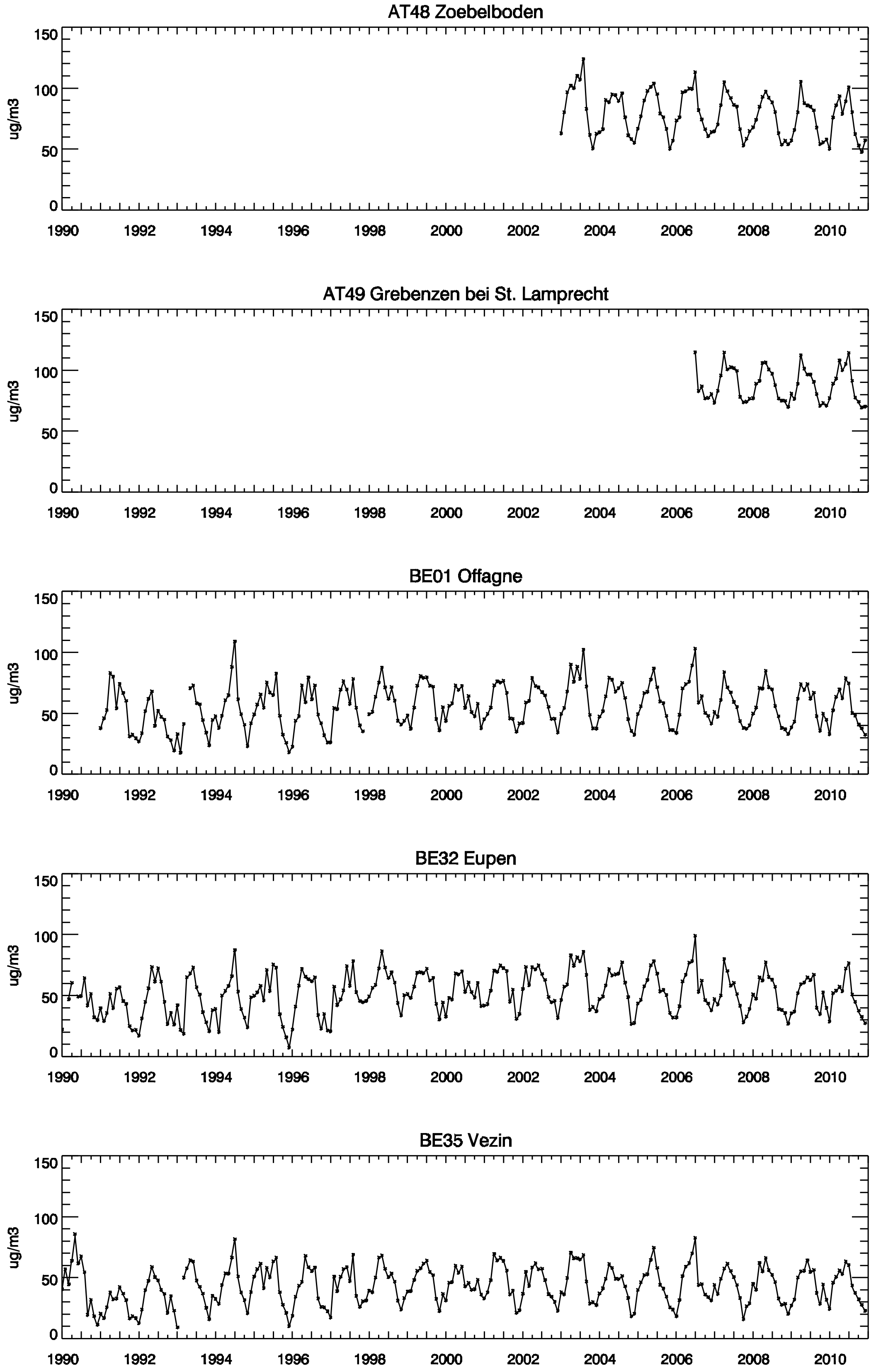

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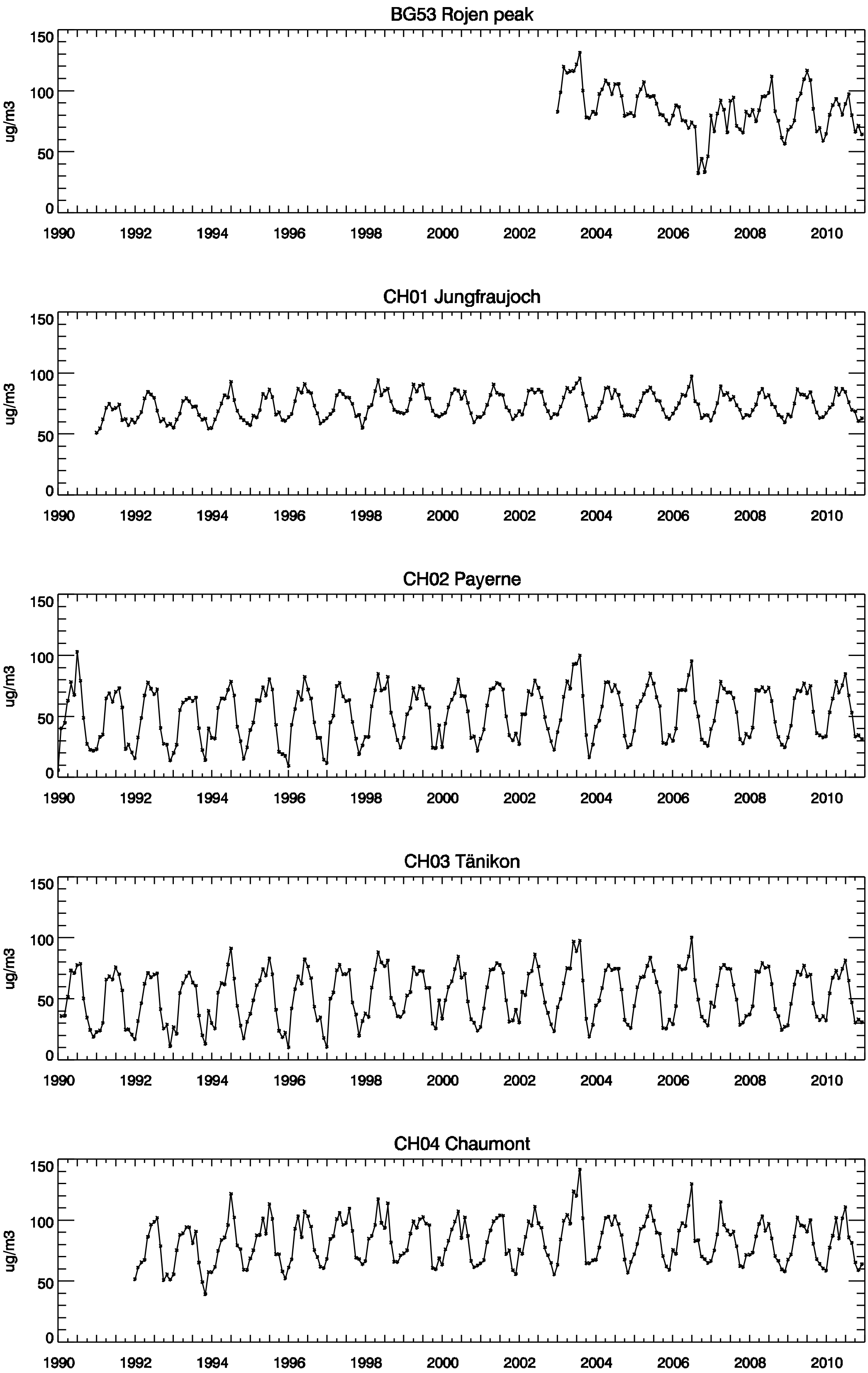

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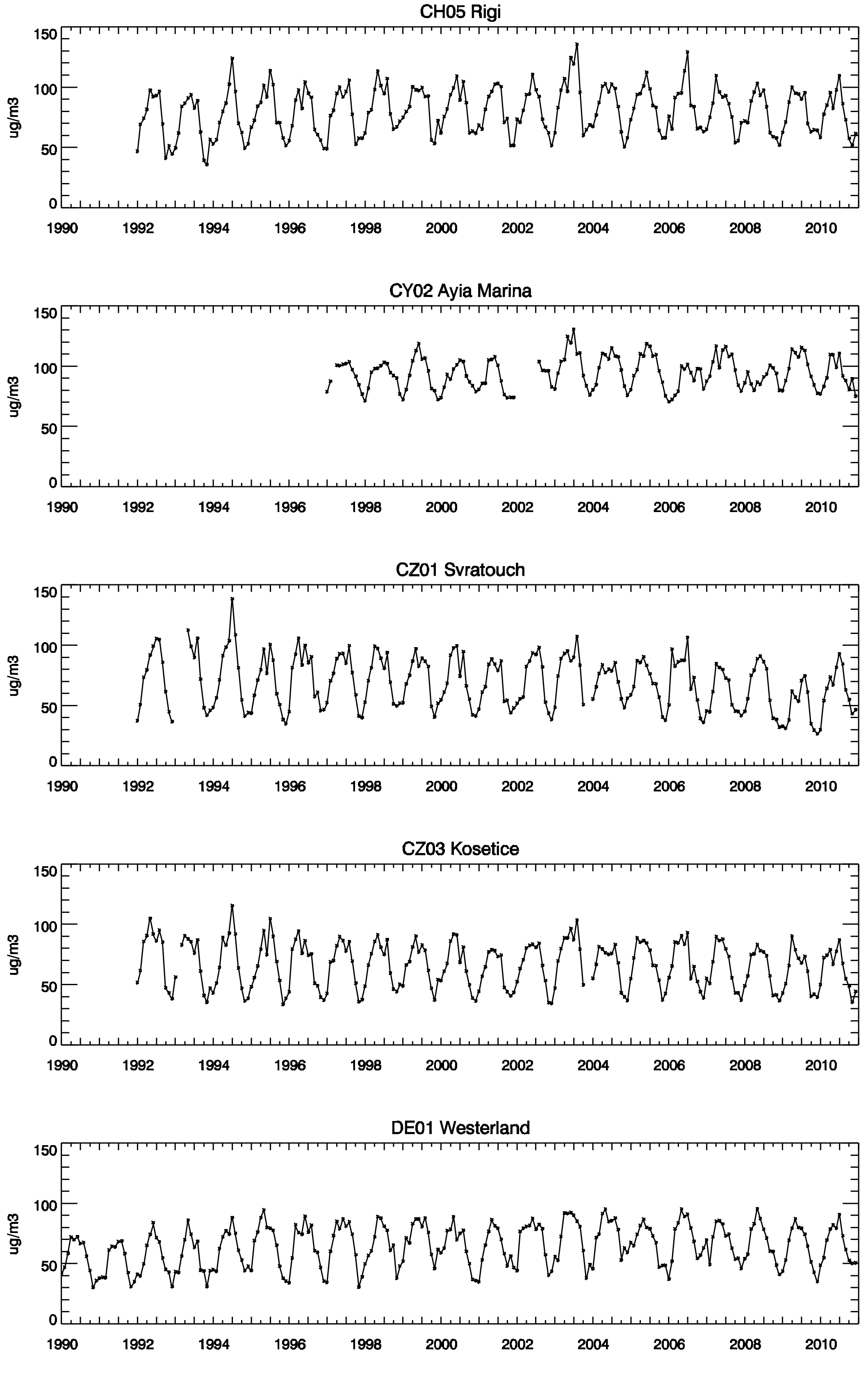

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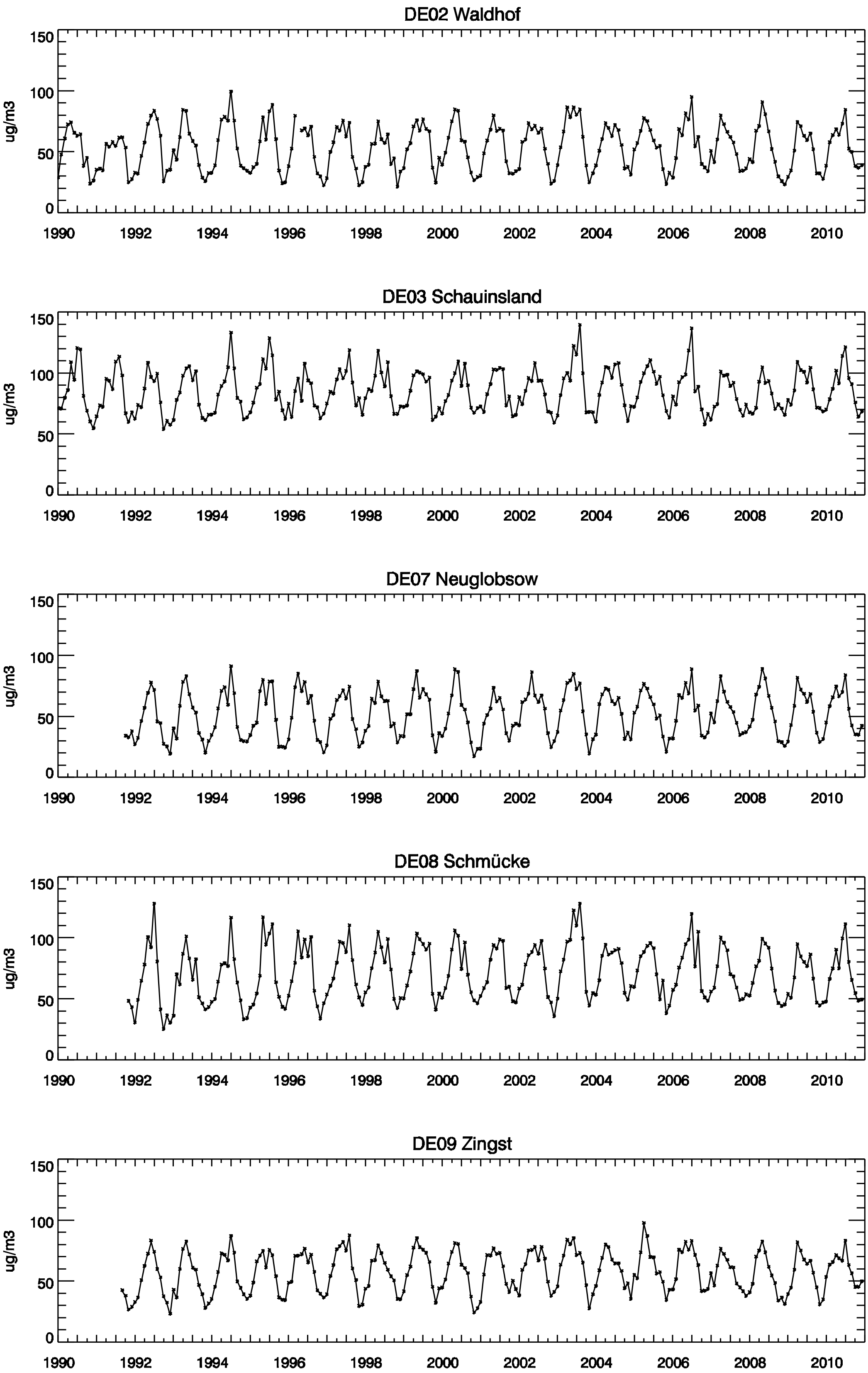

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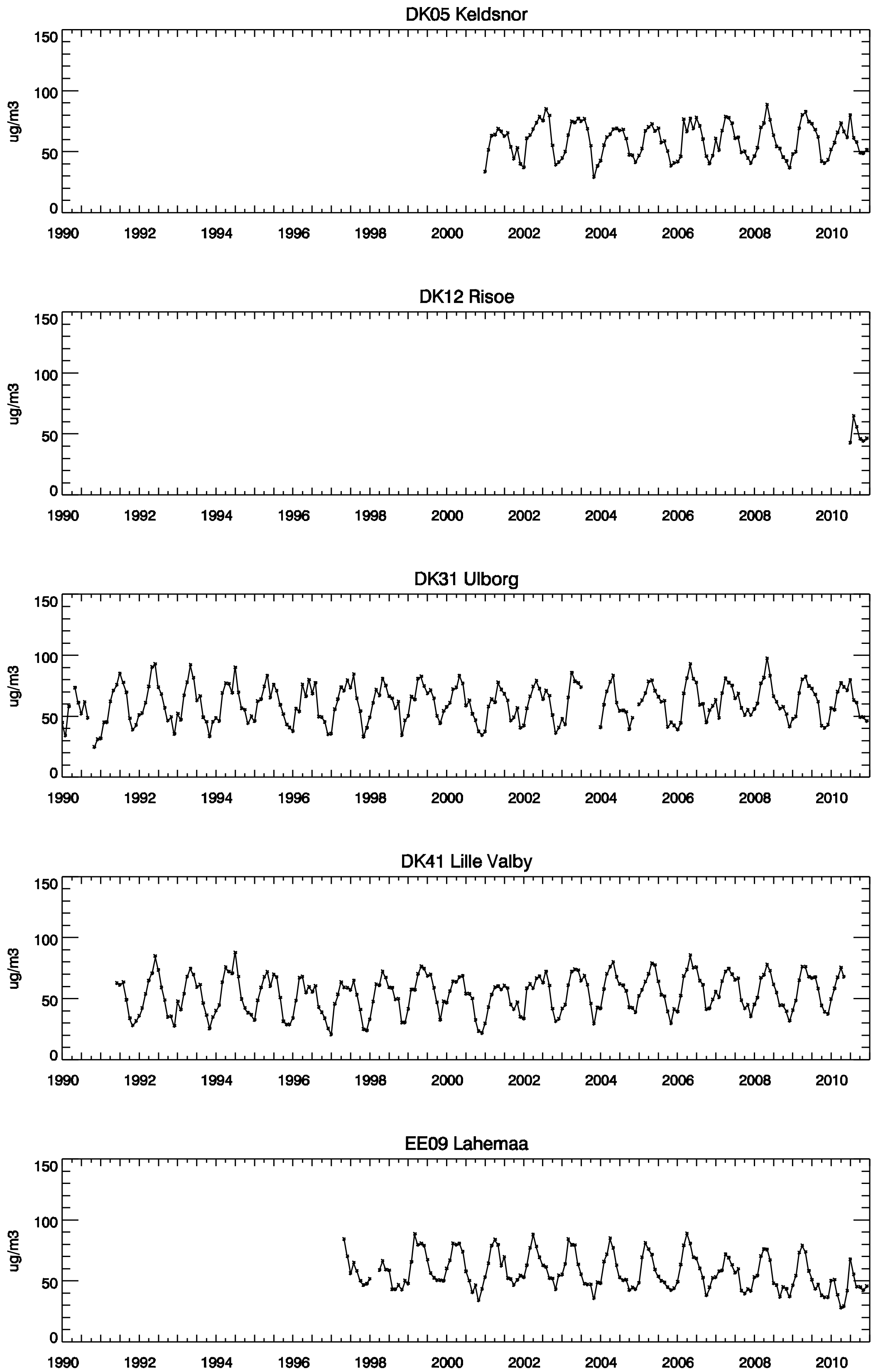

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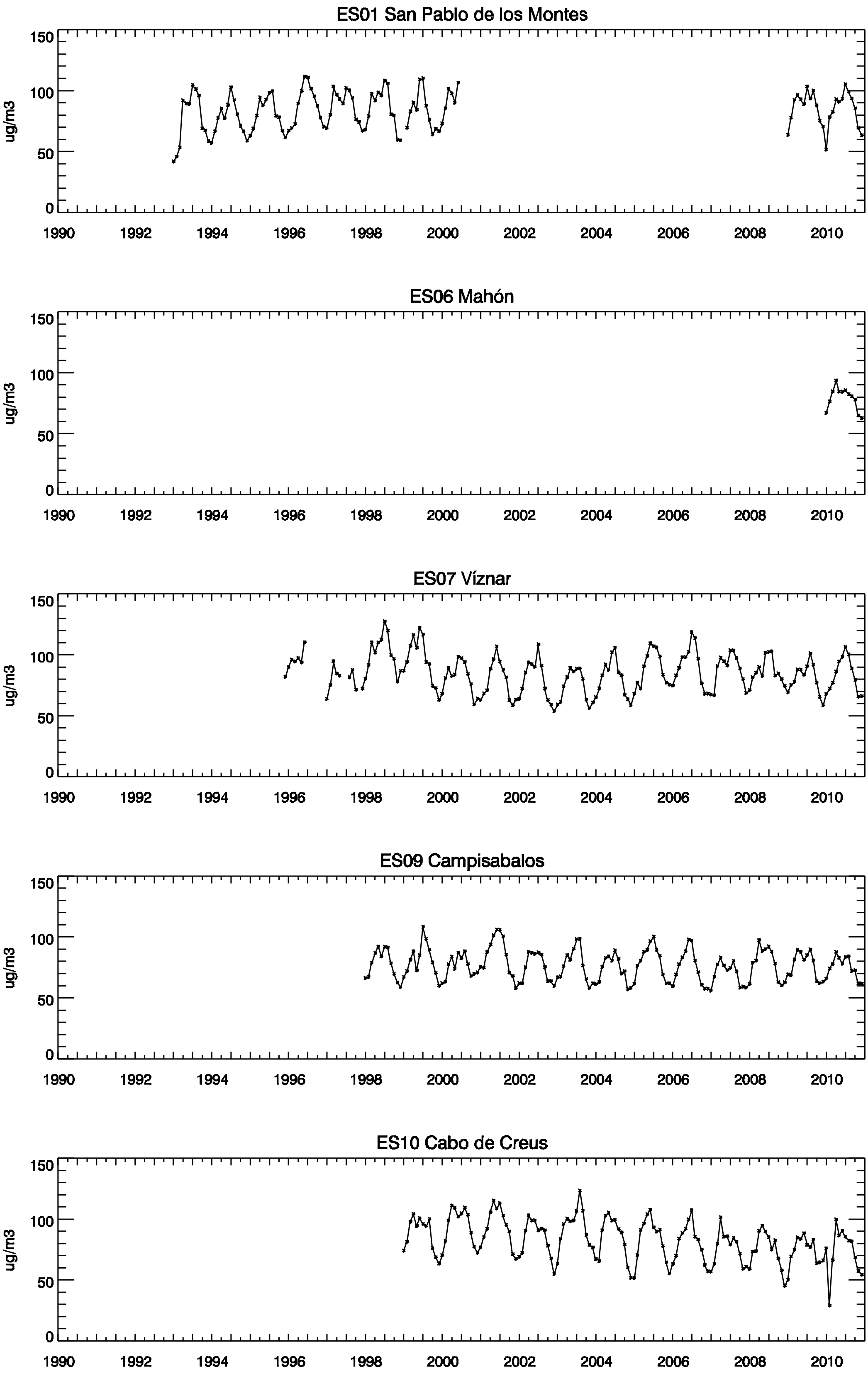

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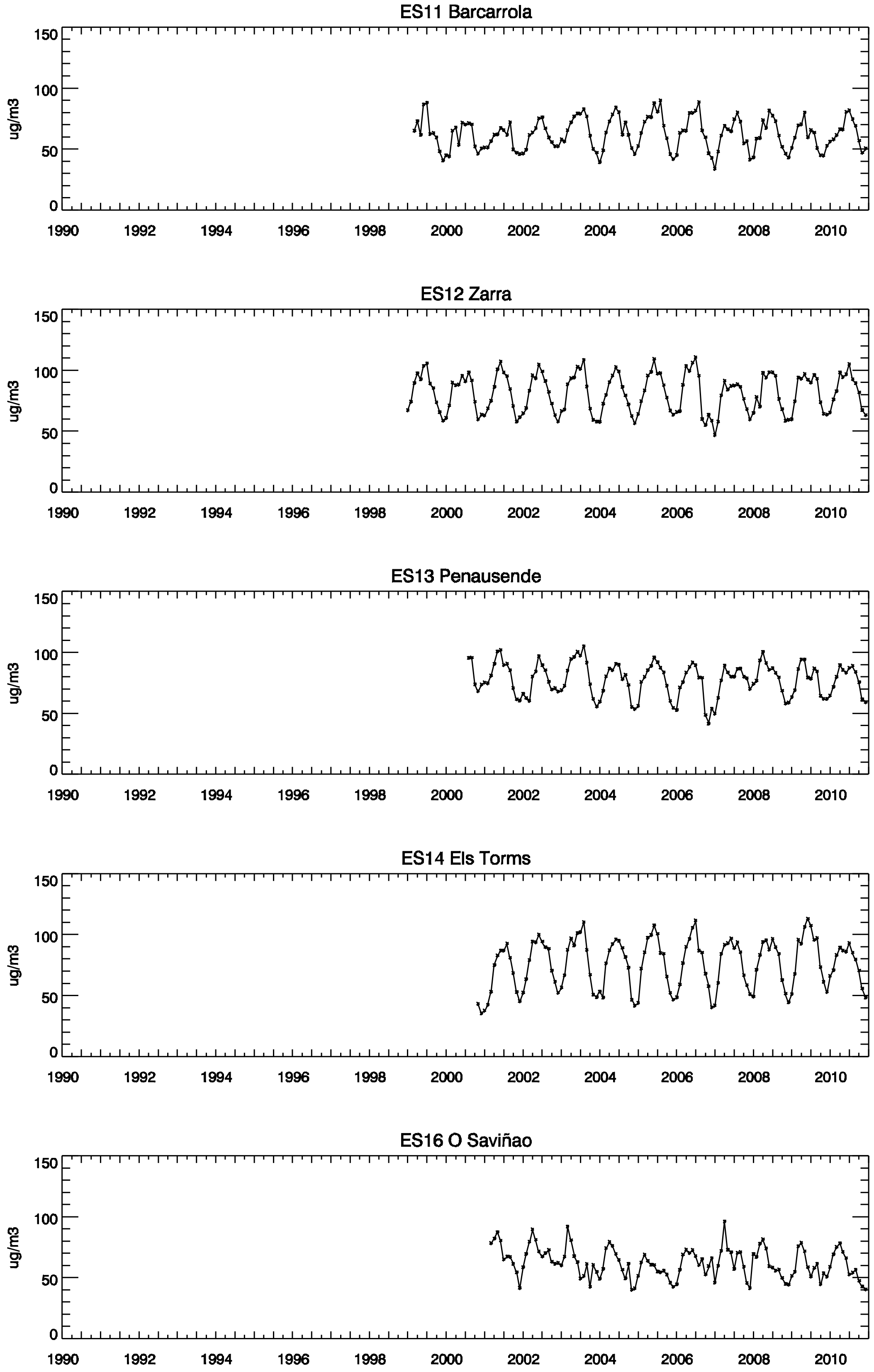

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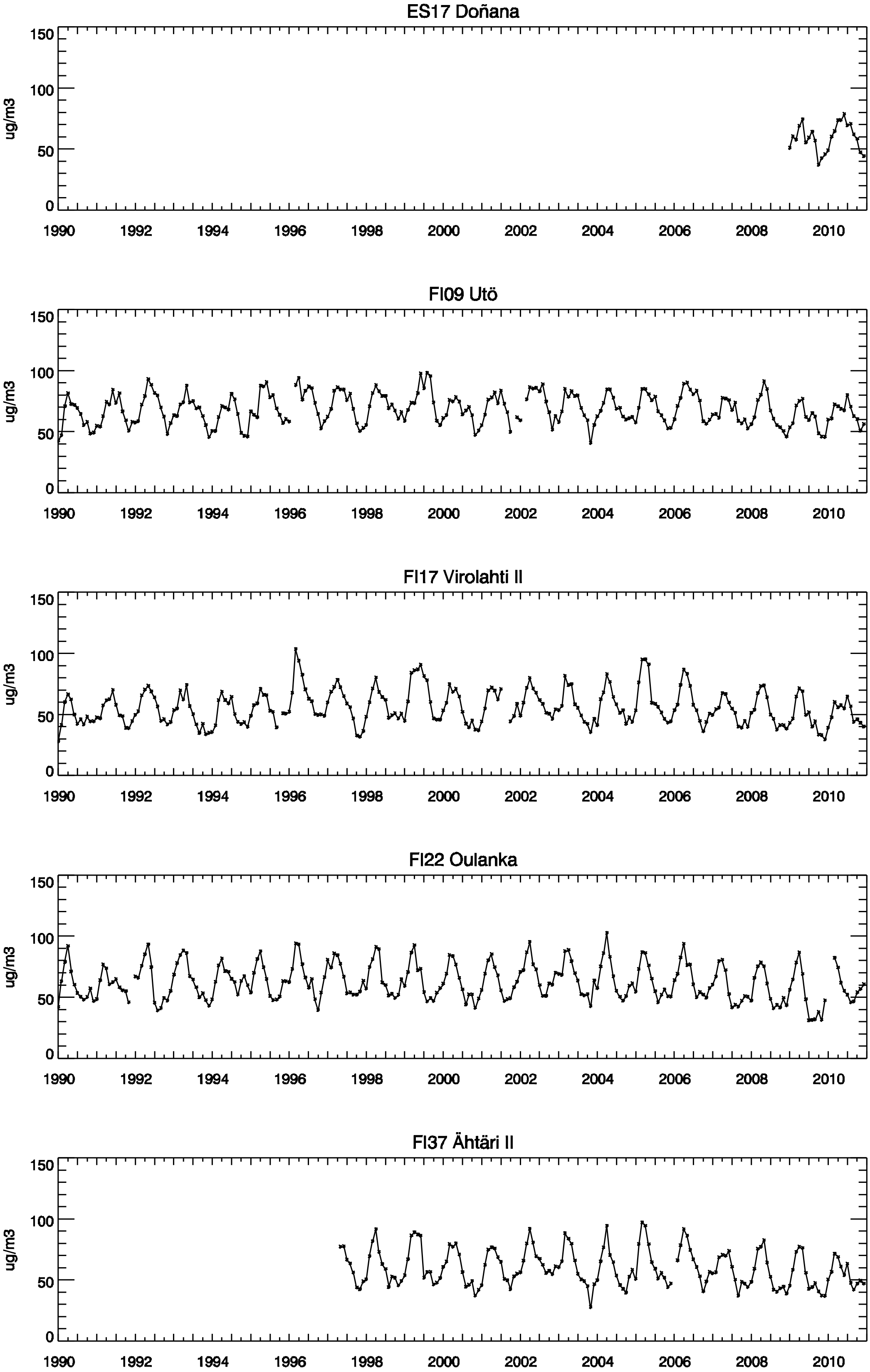

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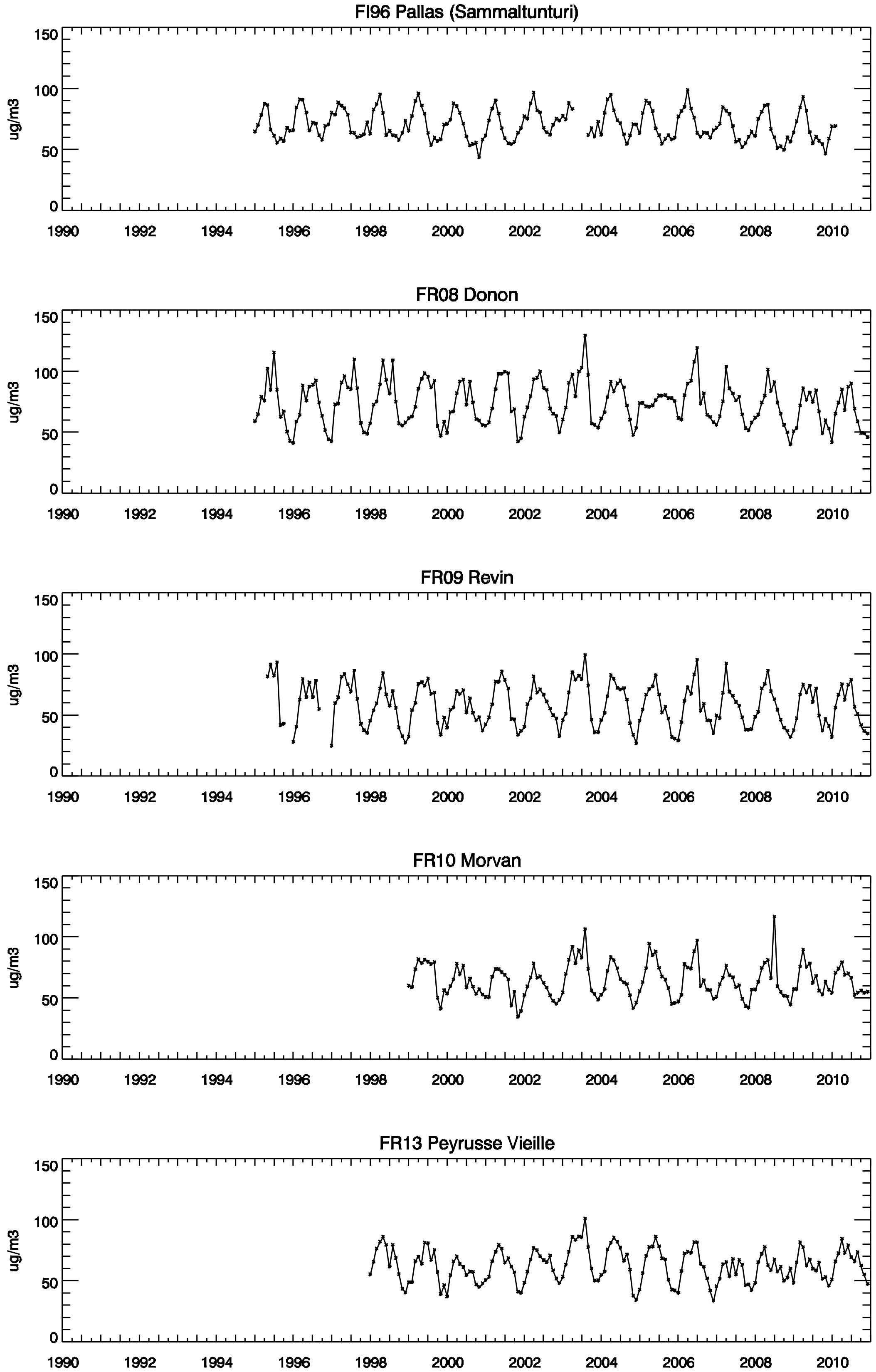

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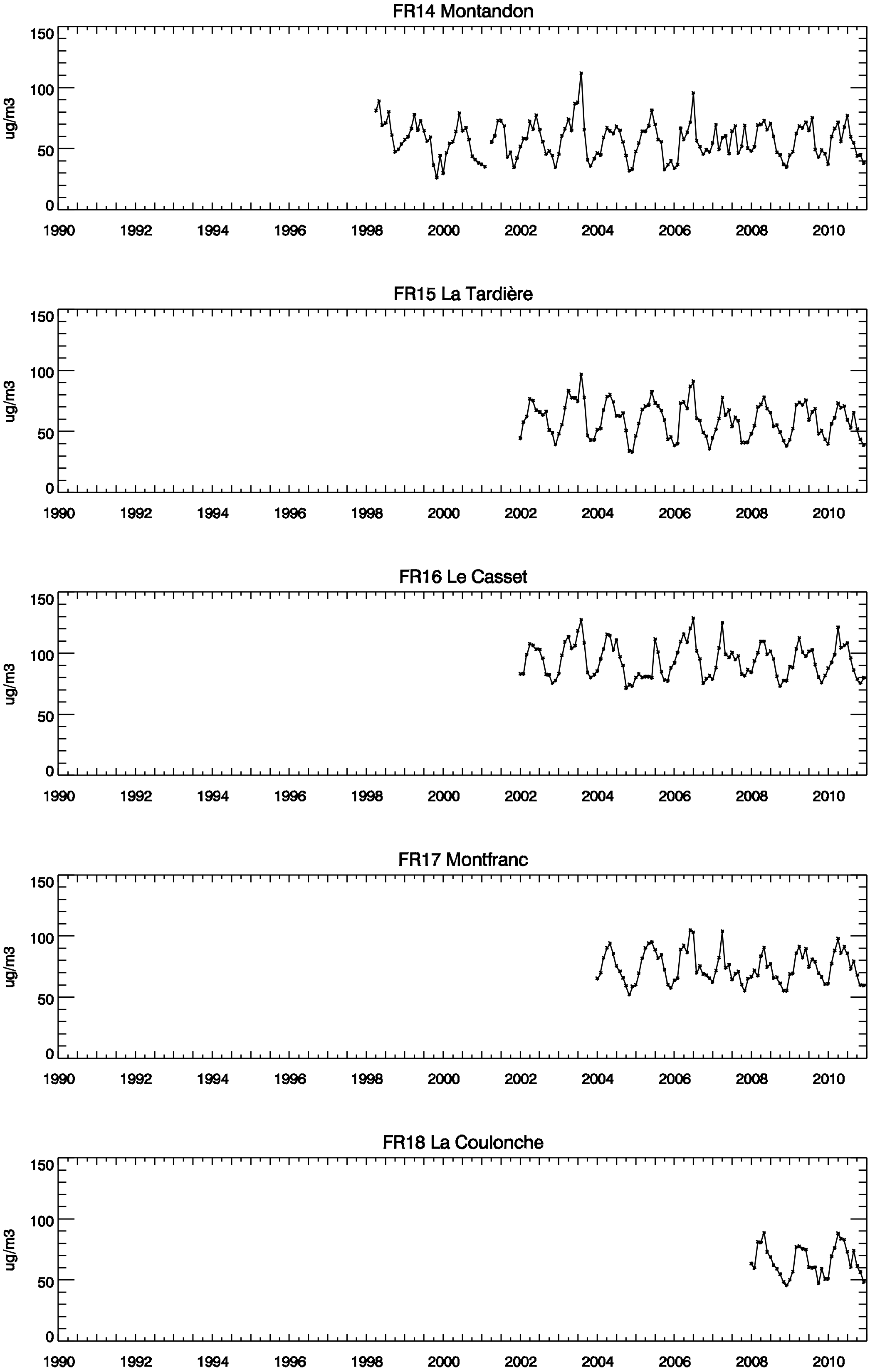

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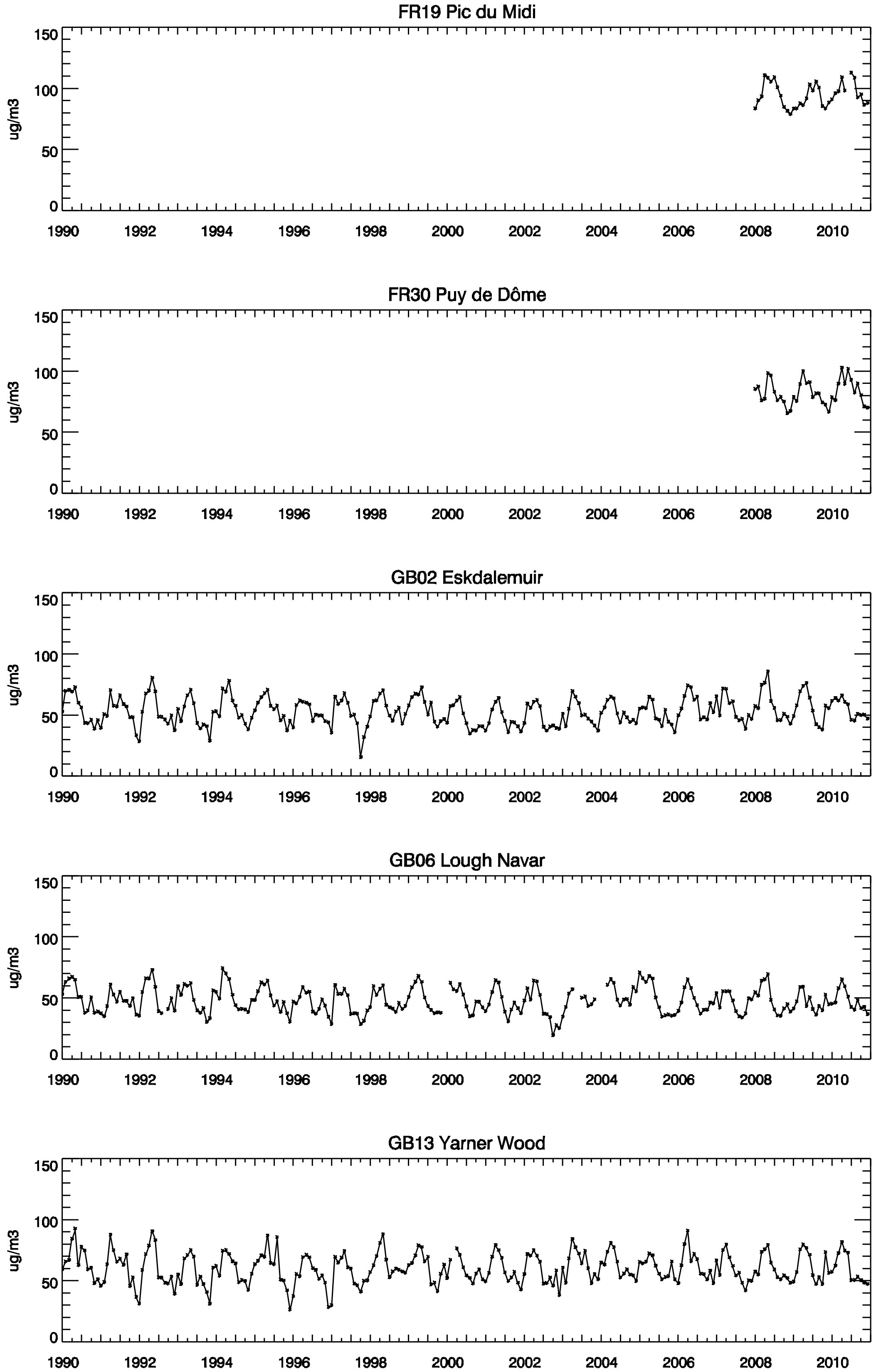

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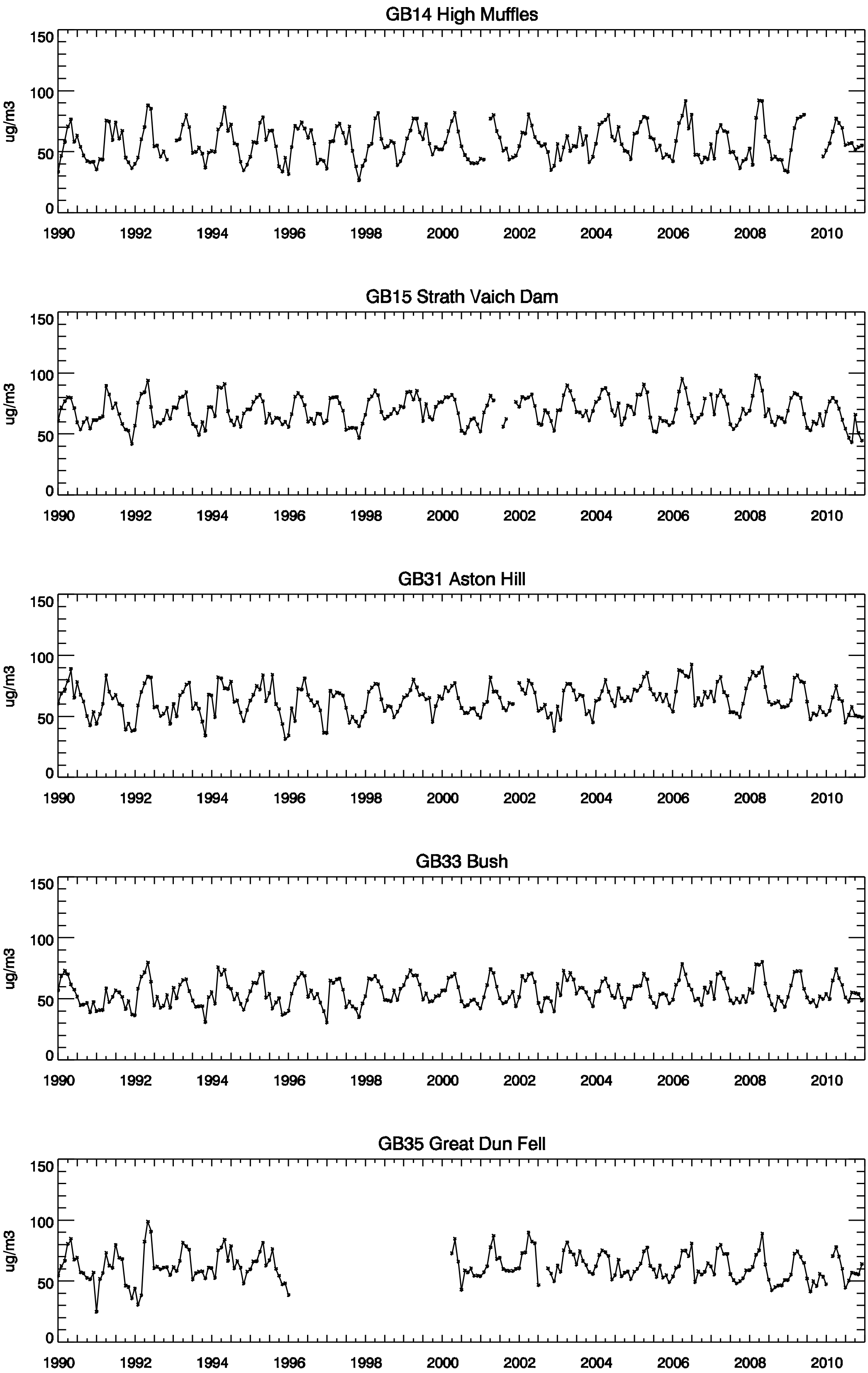

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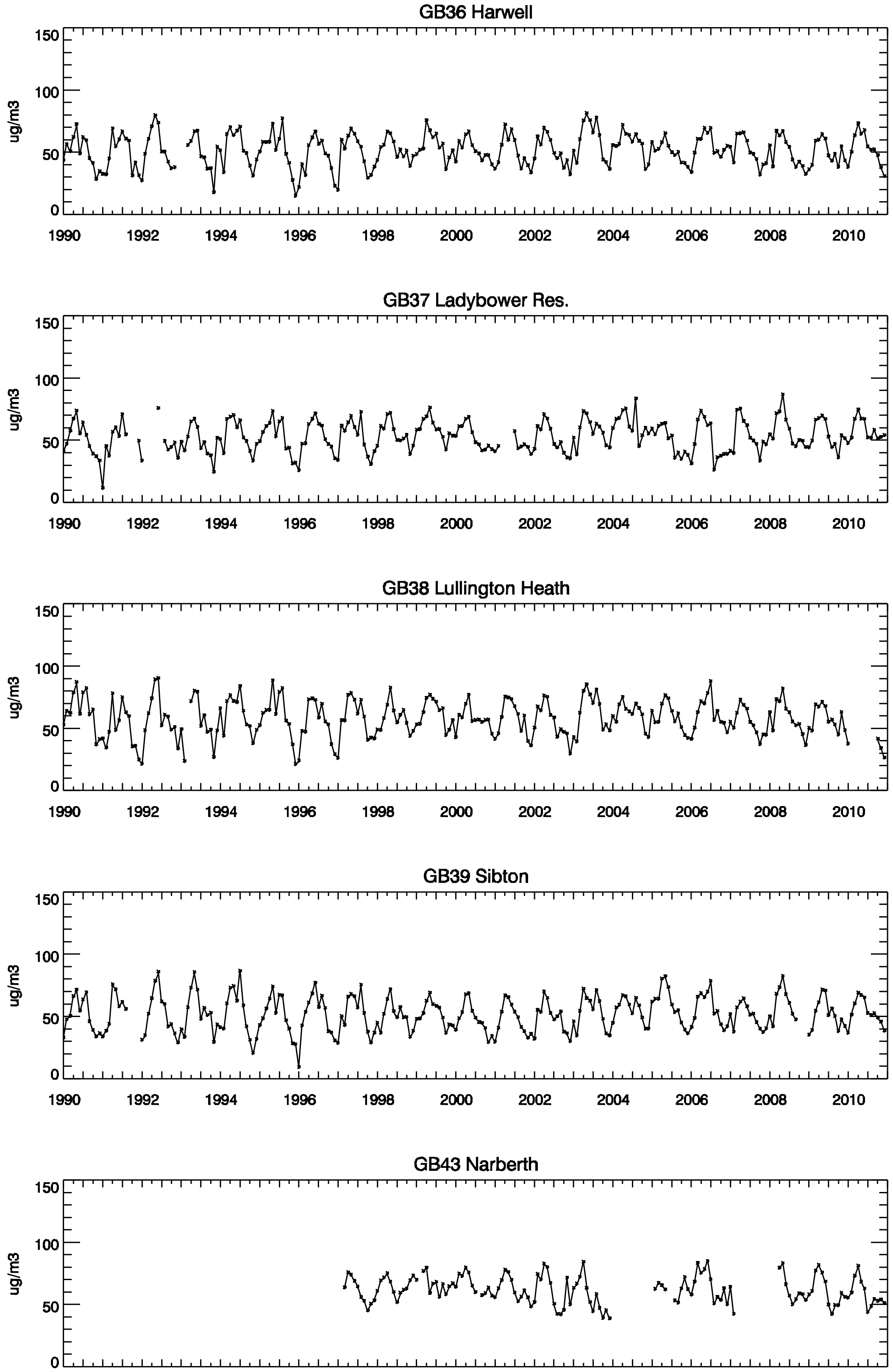

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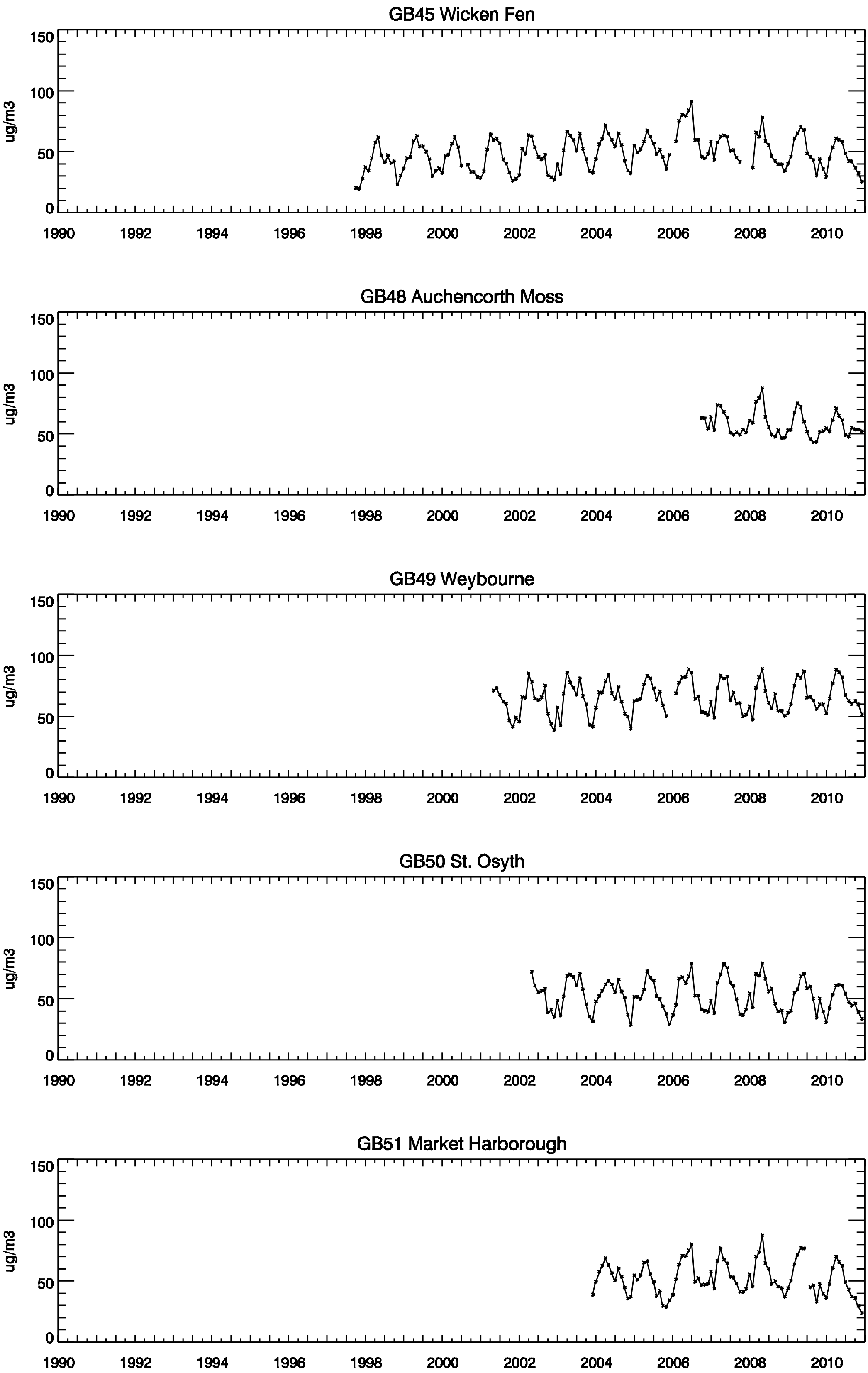

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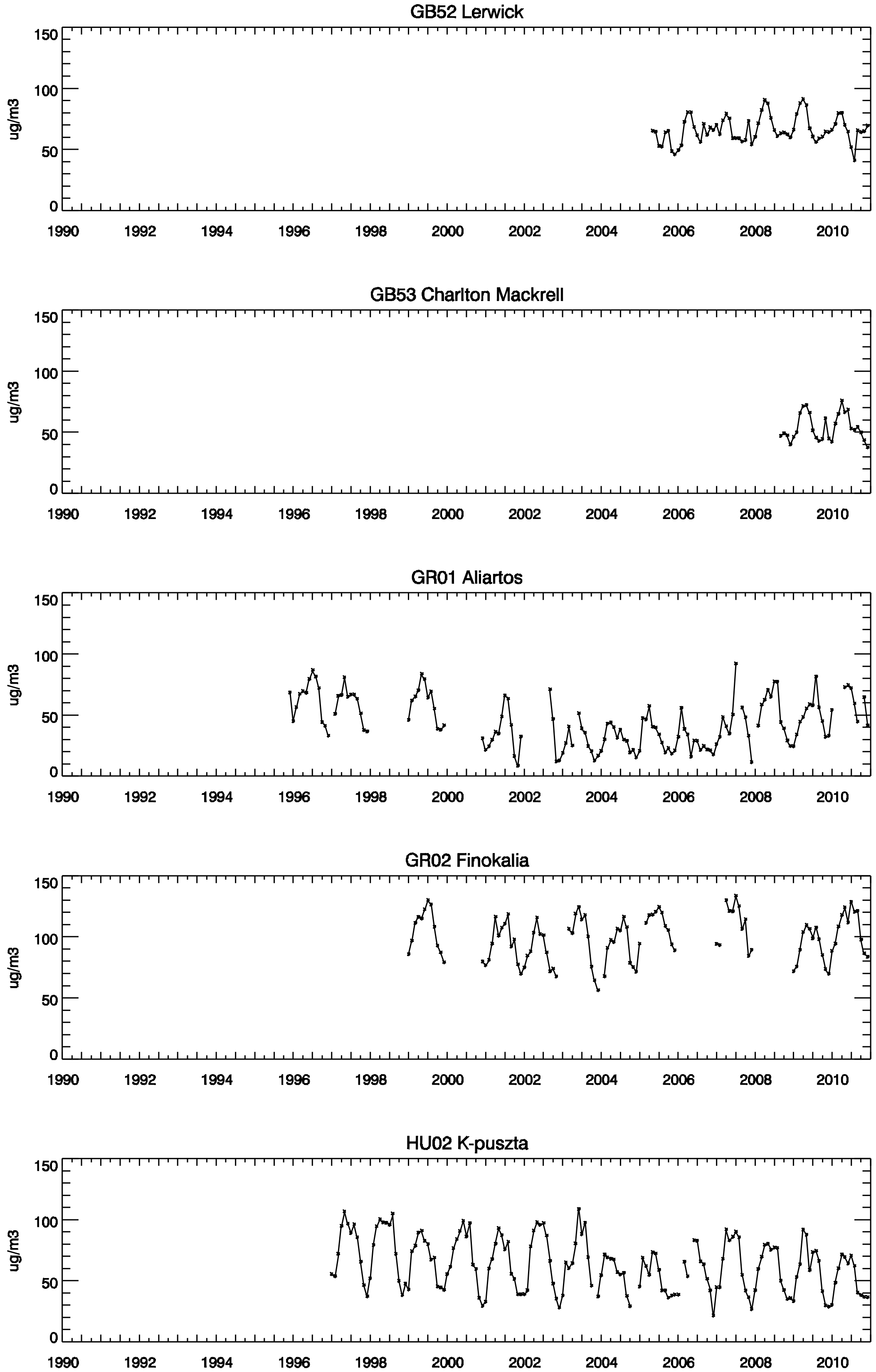

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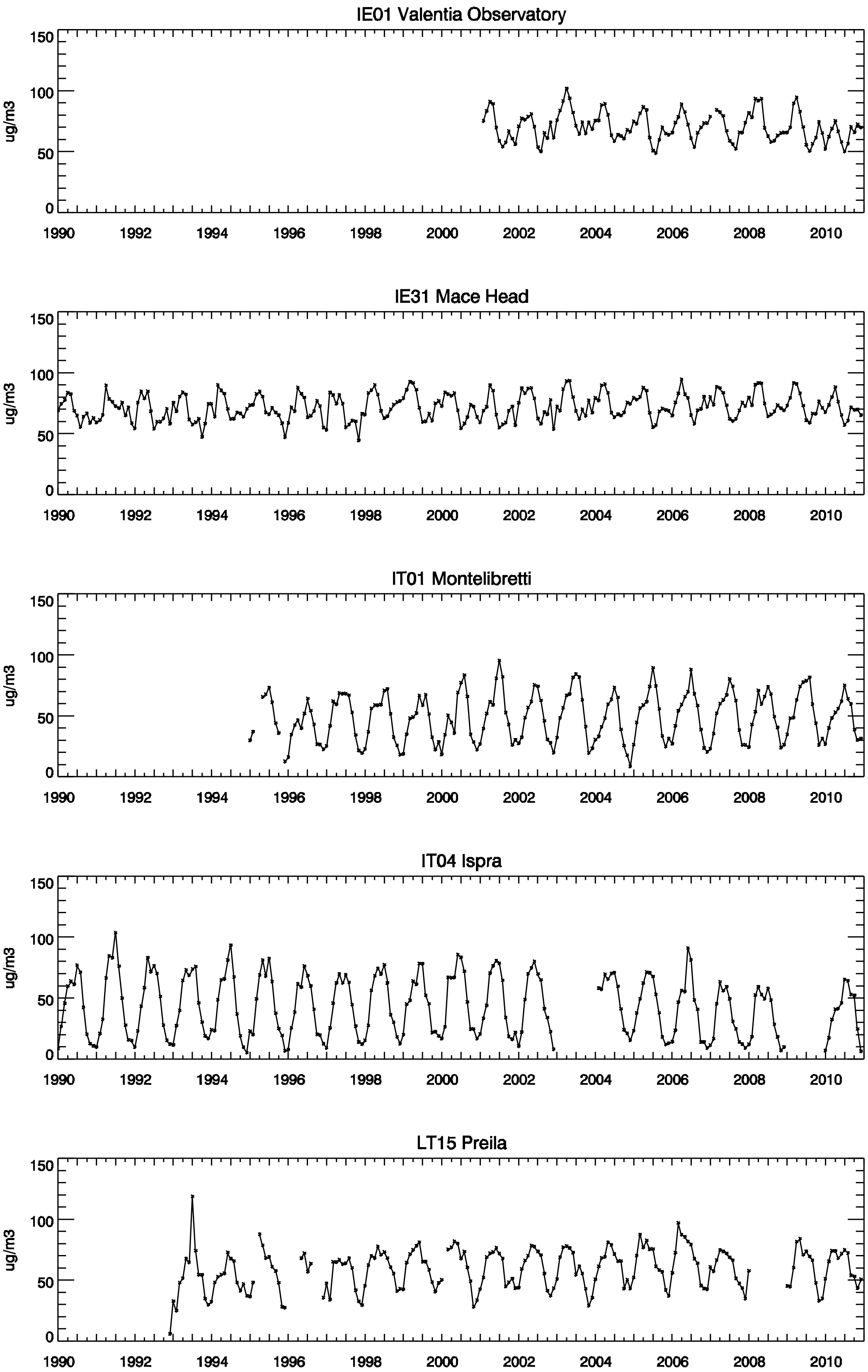

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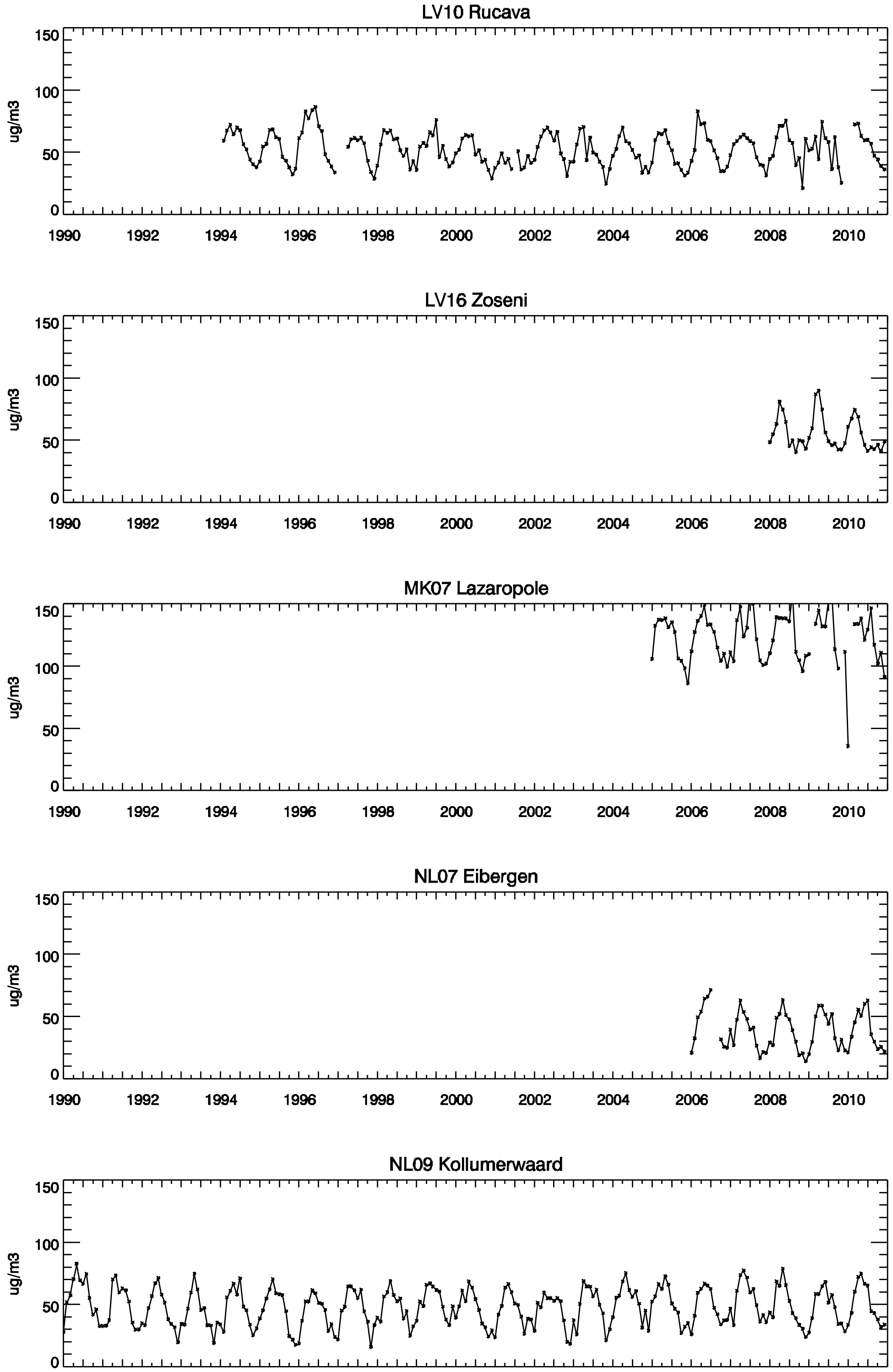

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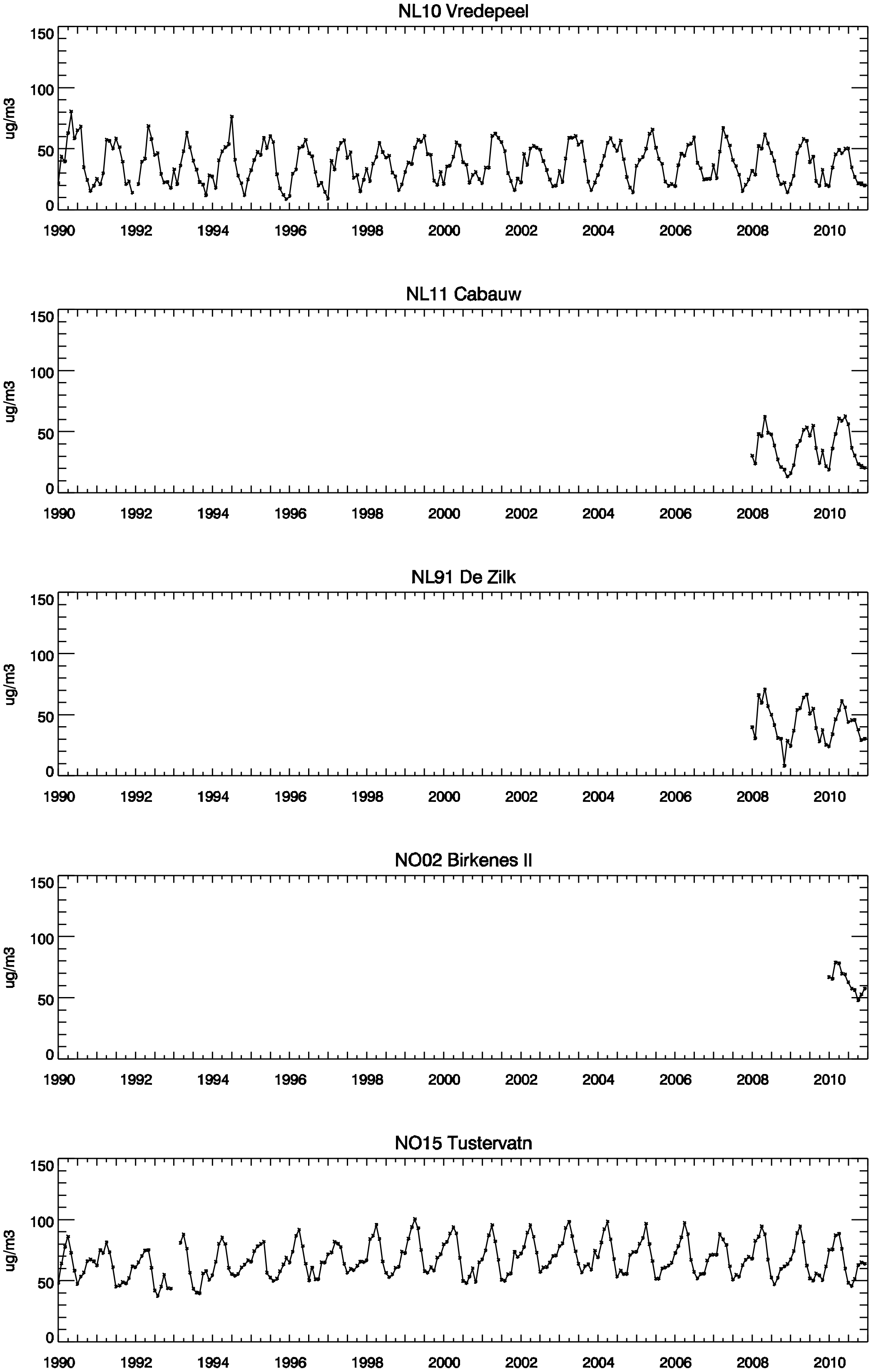

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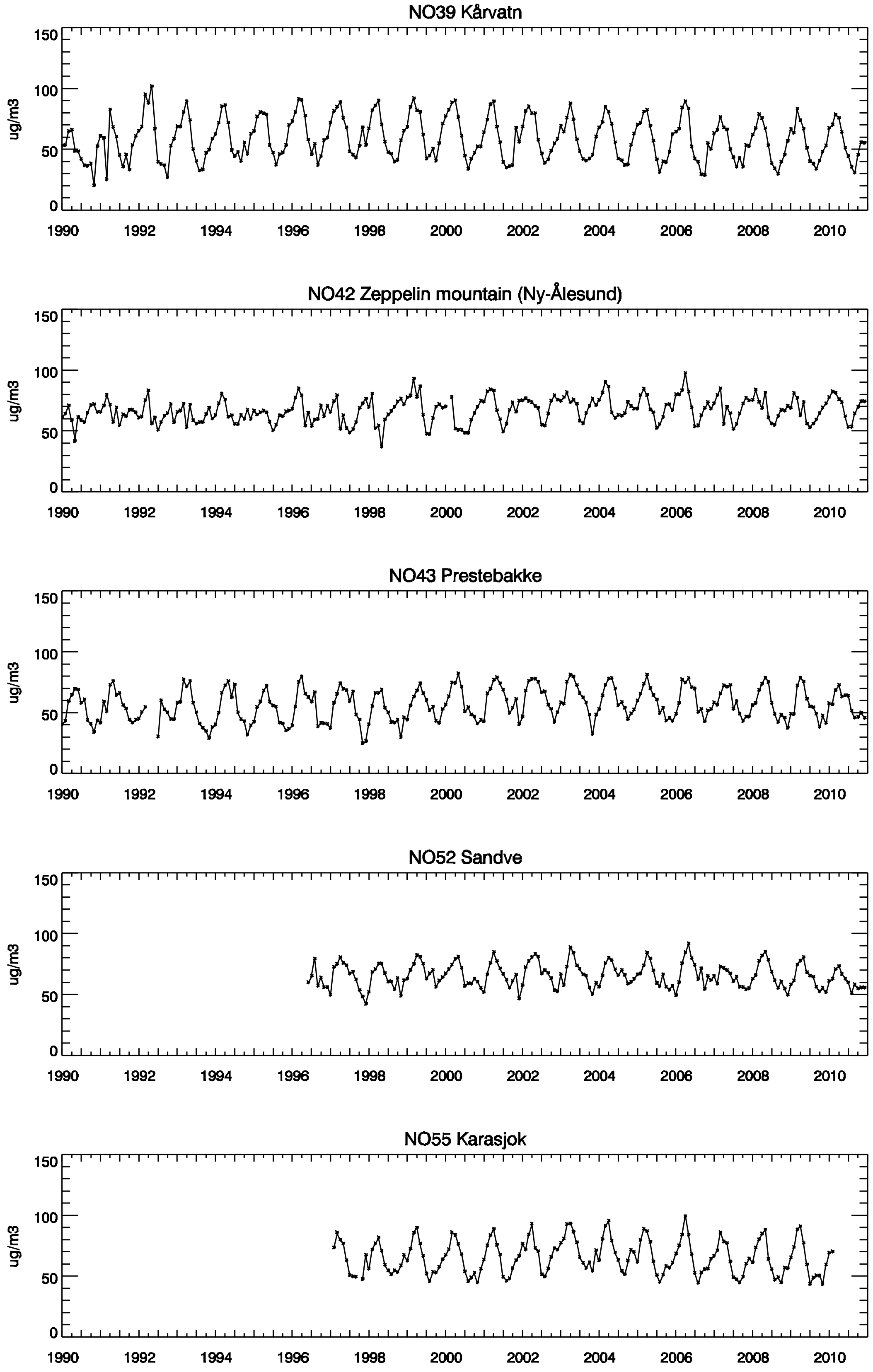

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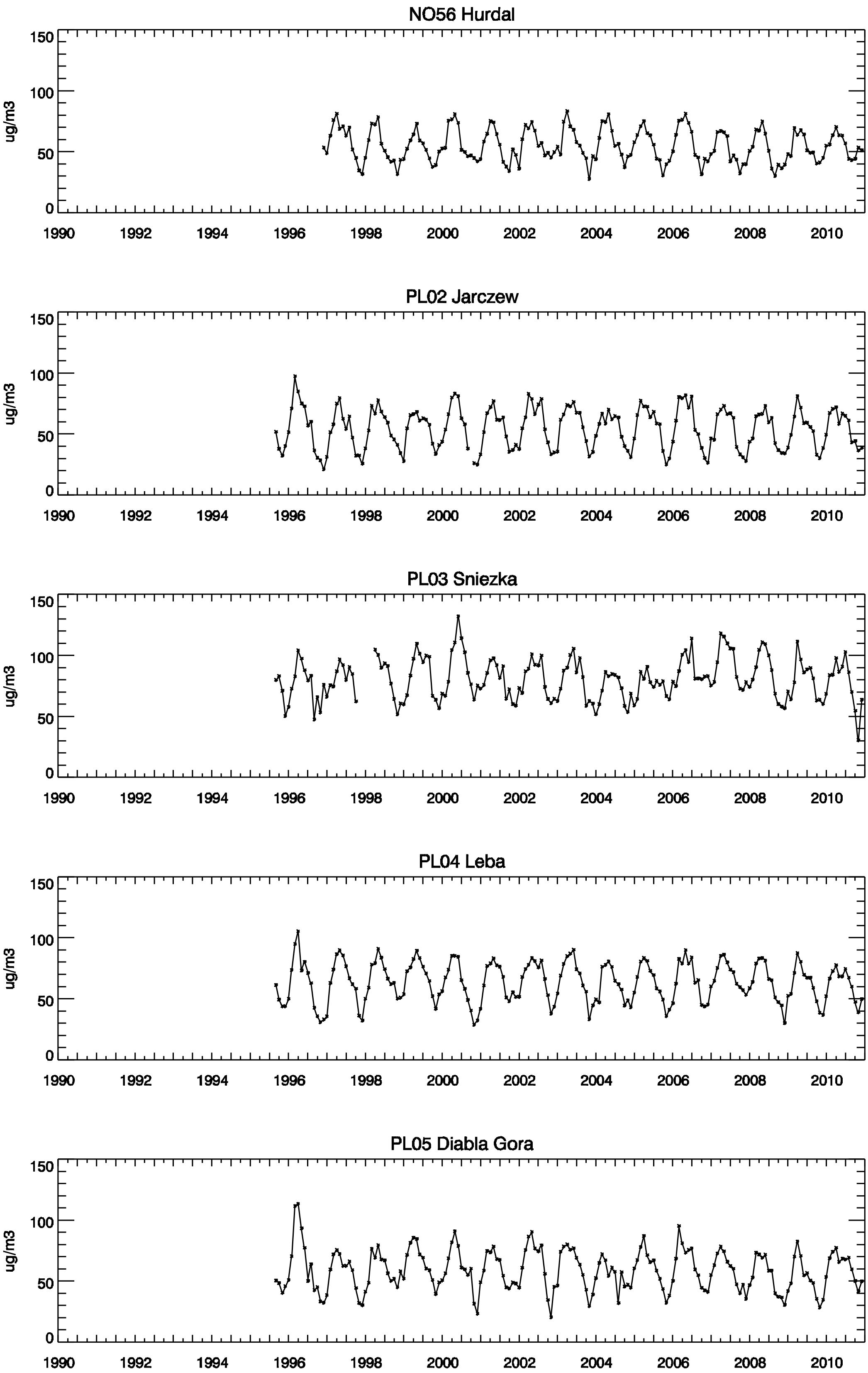

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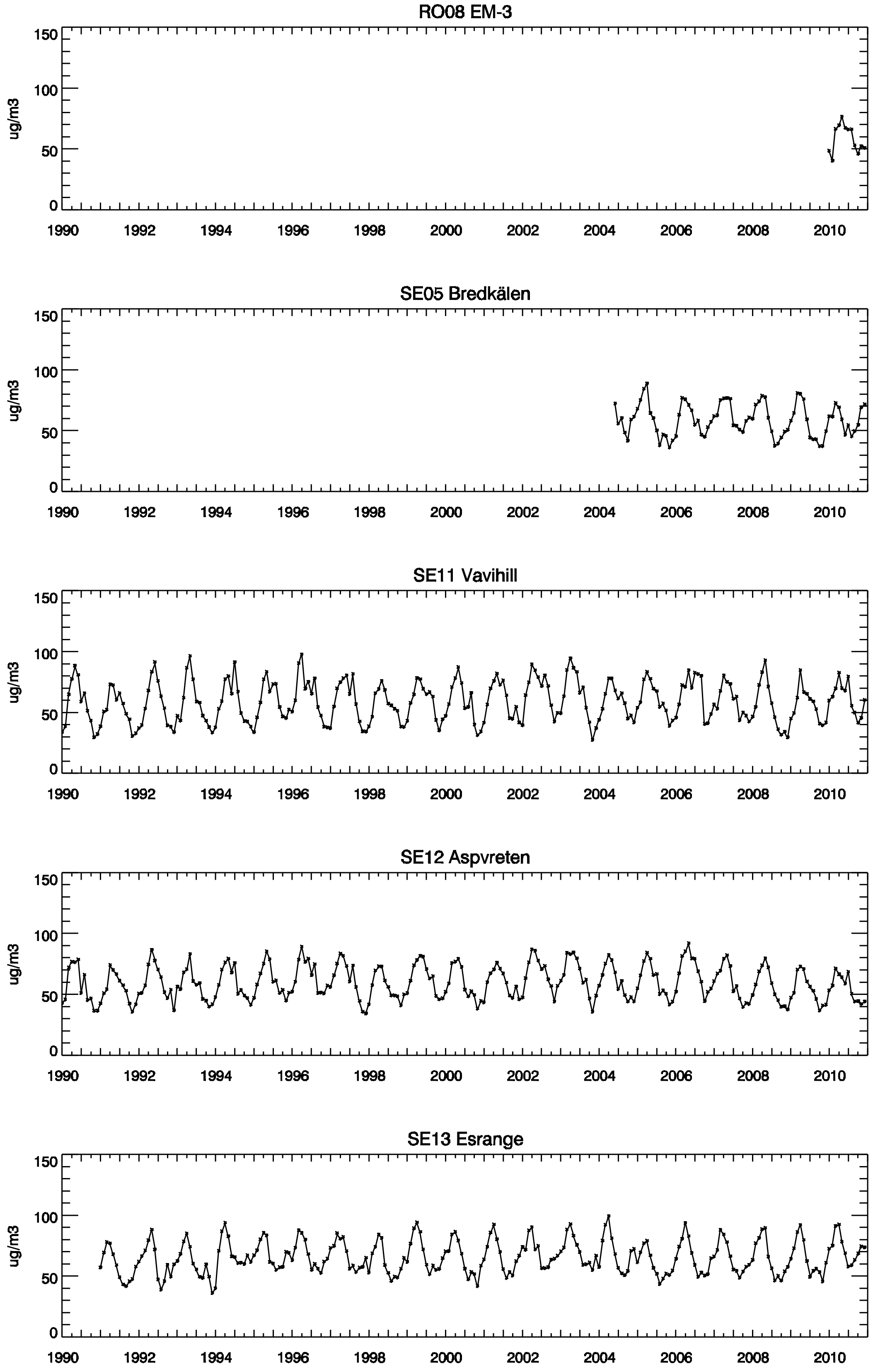

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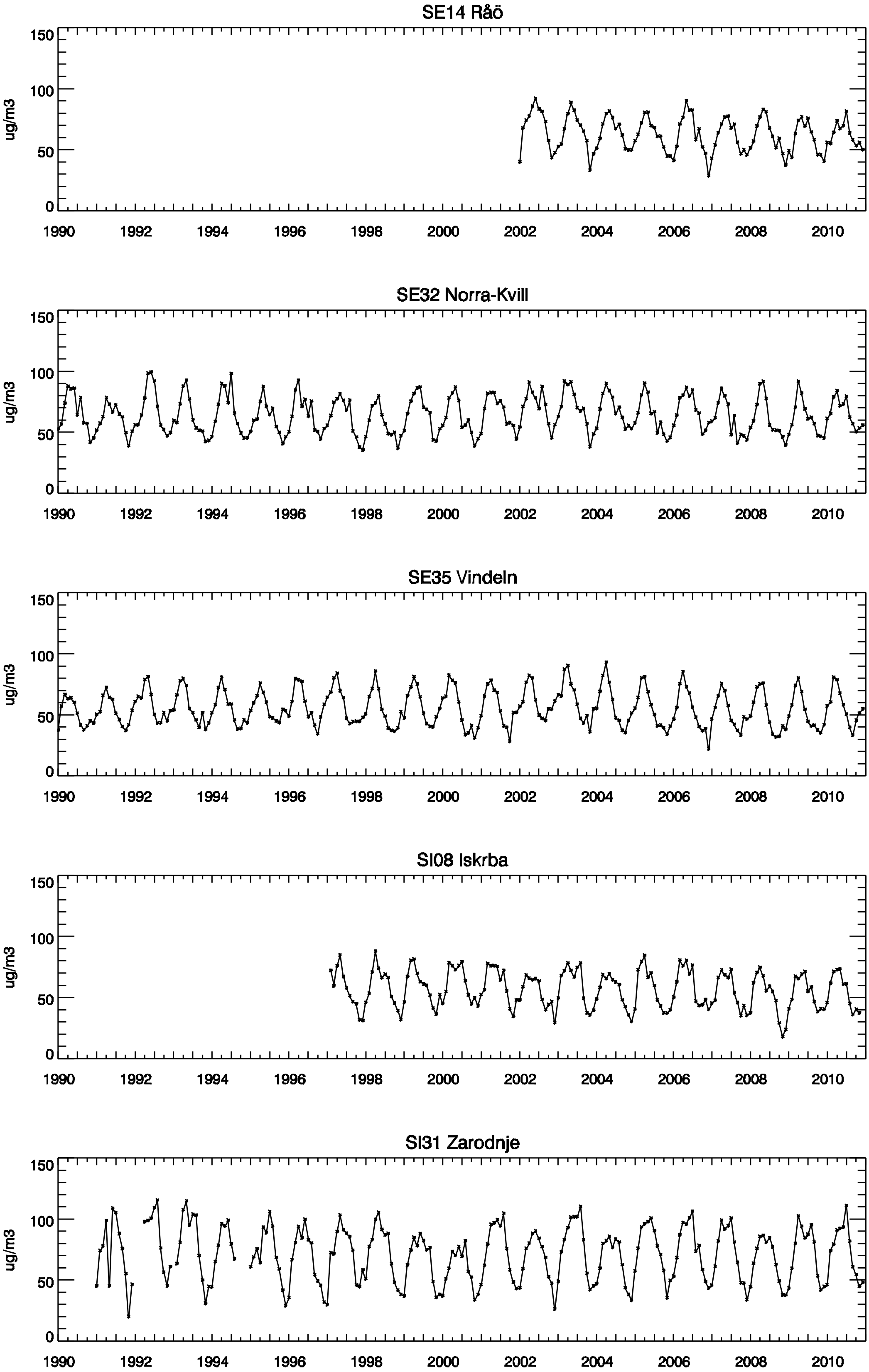

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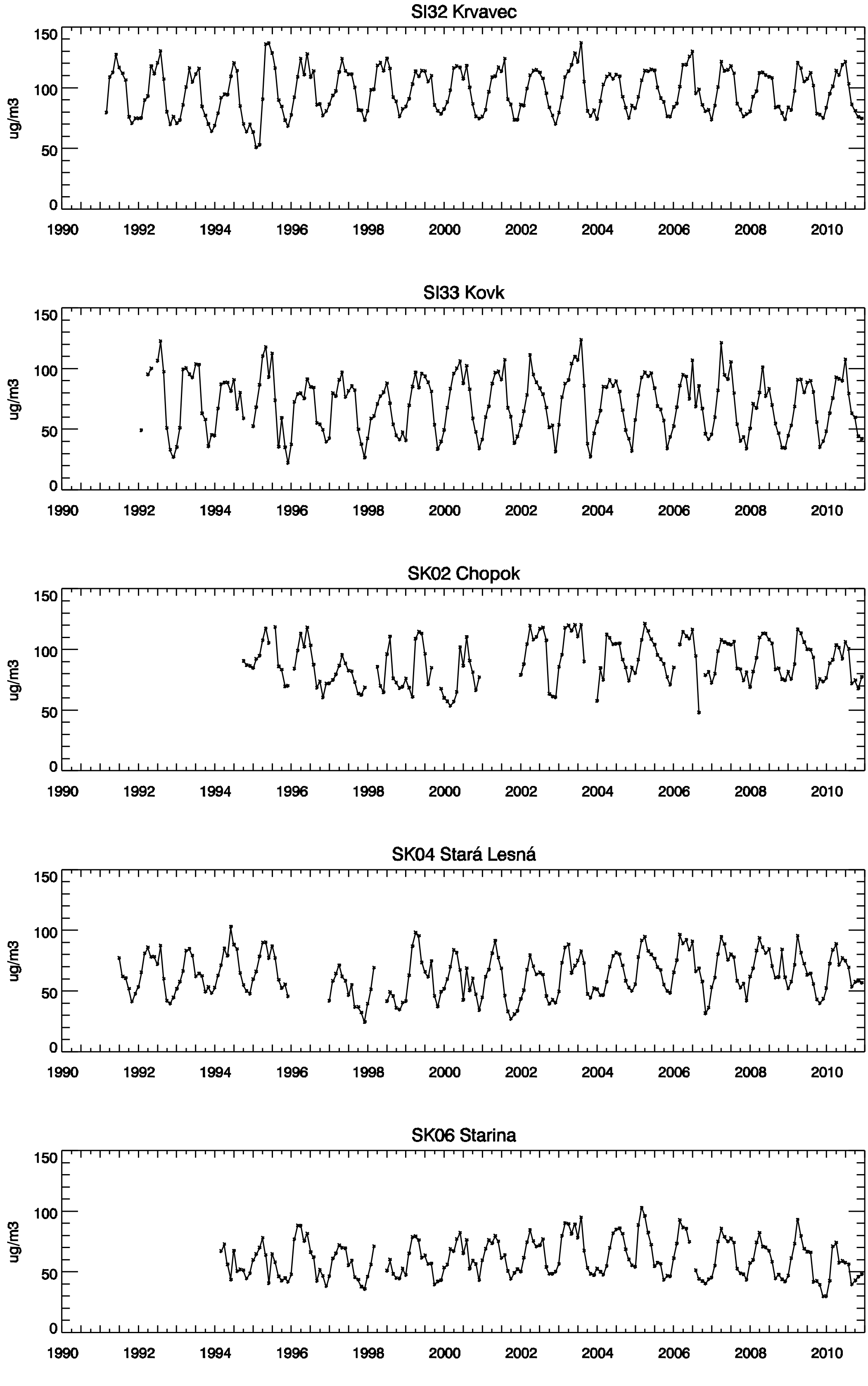

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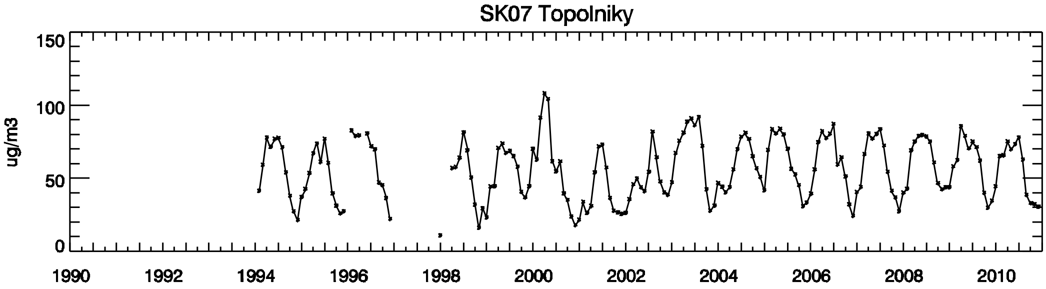


Figure 3.1, cont.

Annex 4

Diurnal variation, April–September 2010

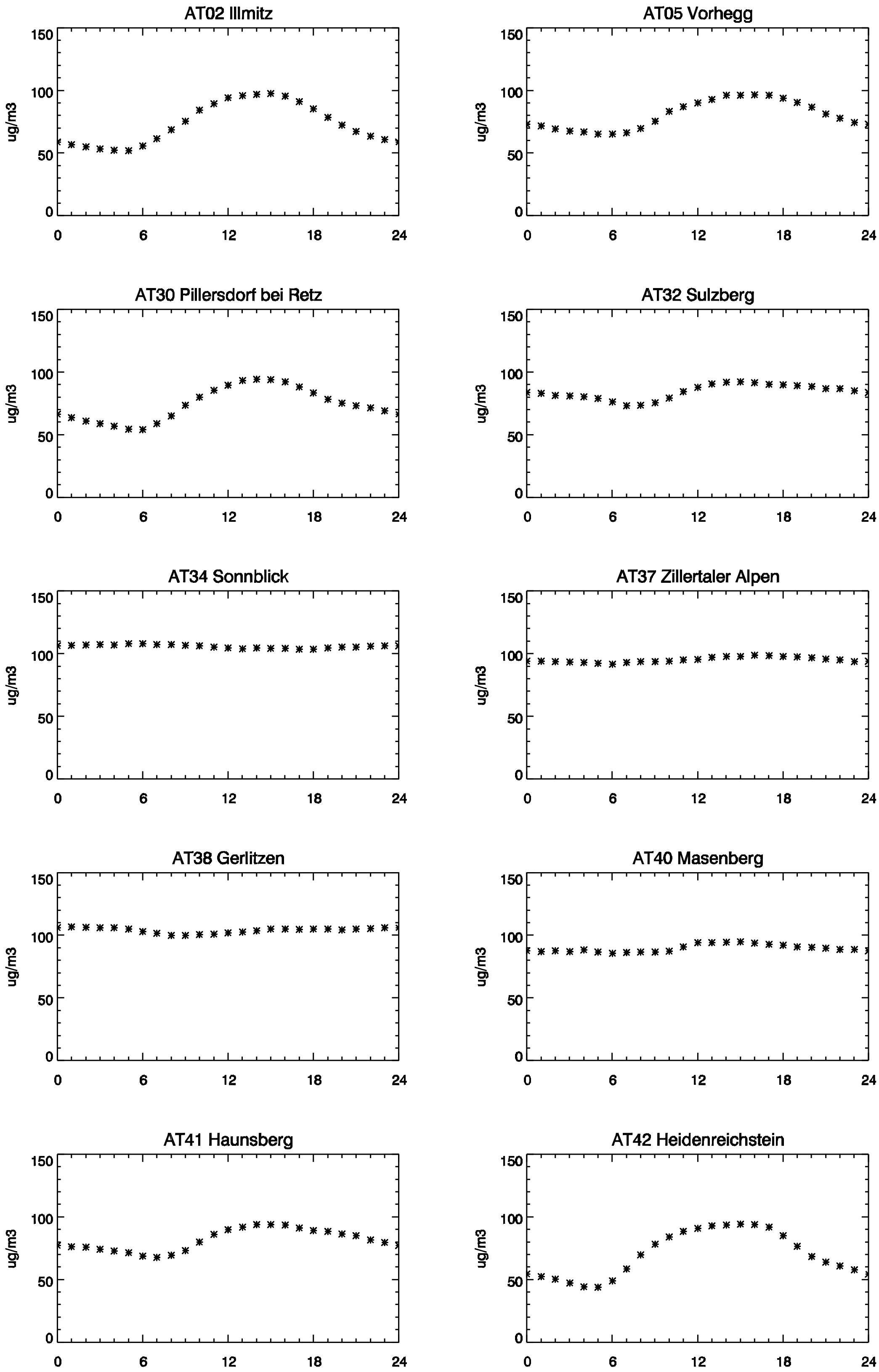


Figure 4.1: Diurnal variation, April–September 2010.

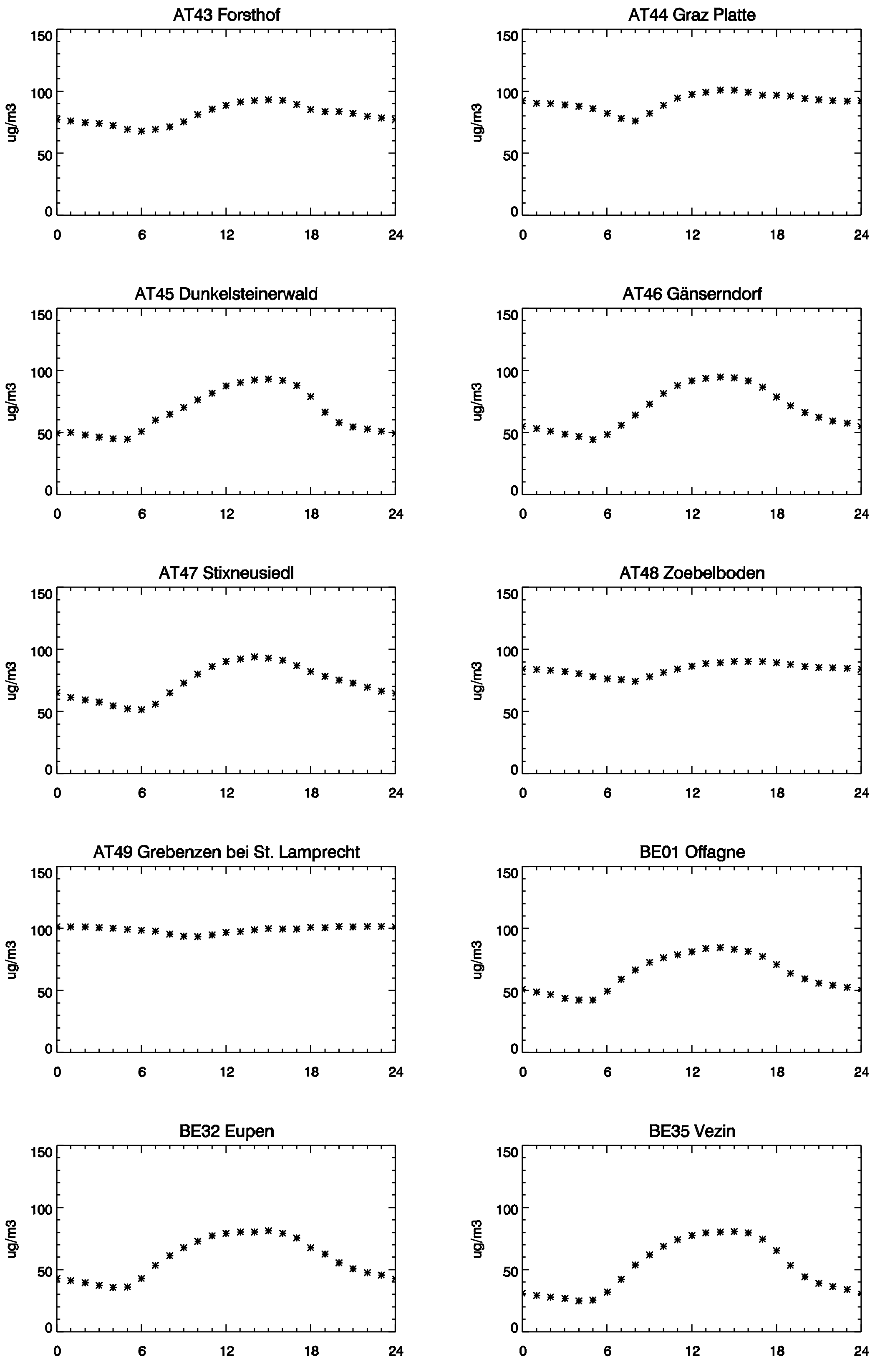


Figure 4.1, cont.

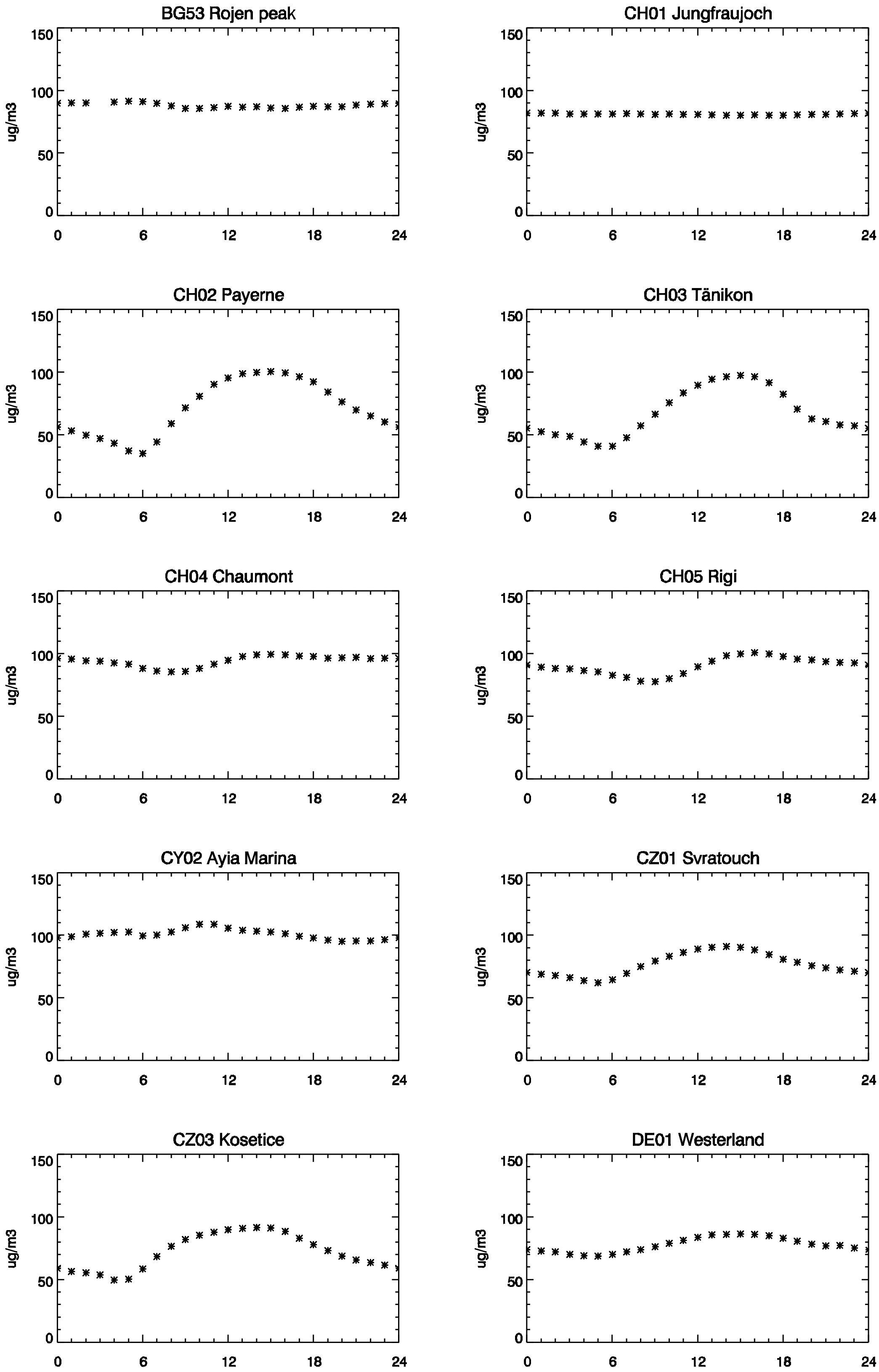
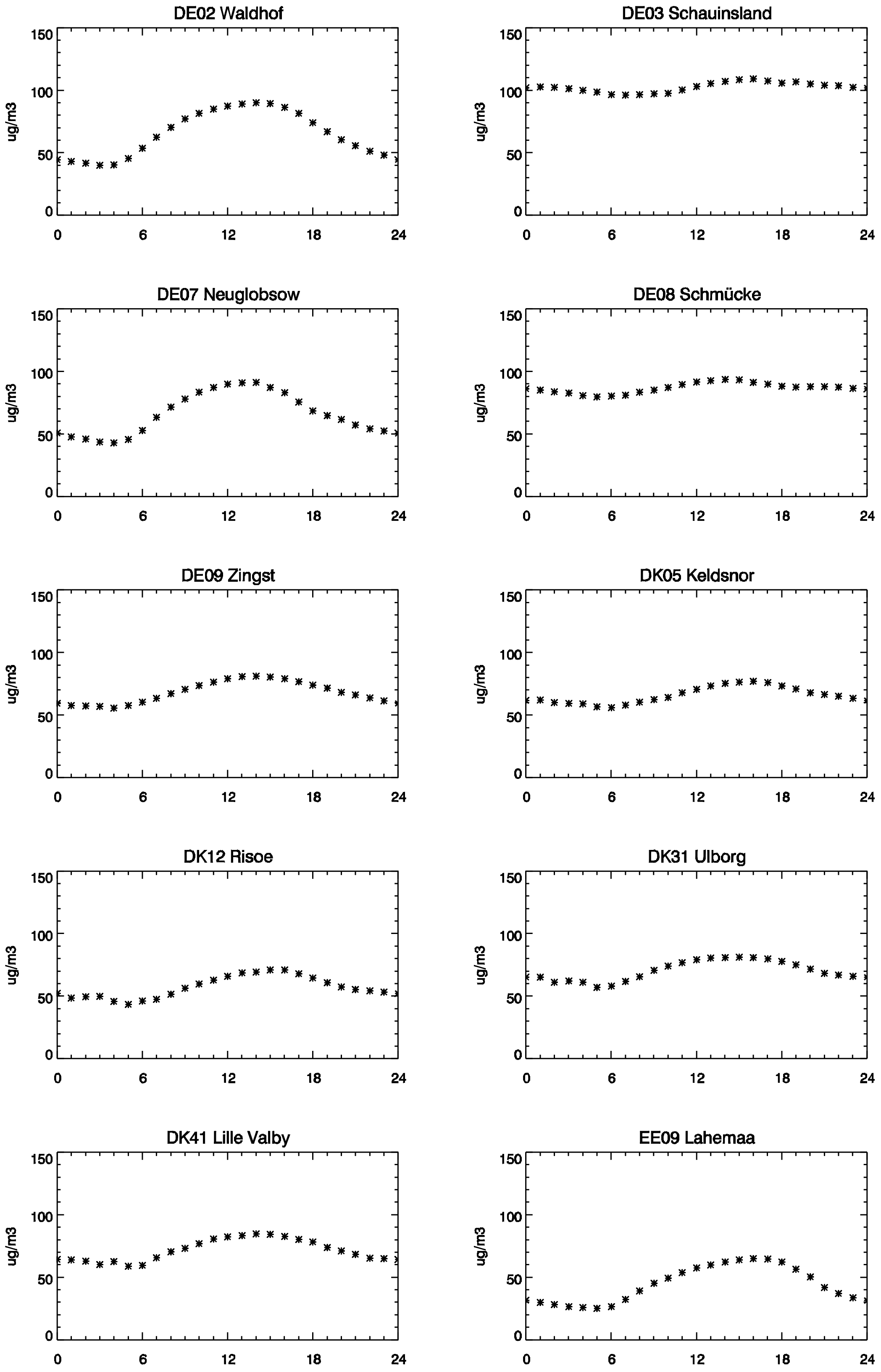


Figure 4.1, cont.



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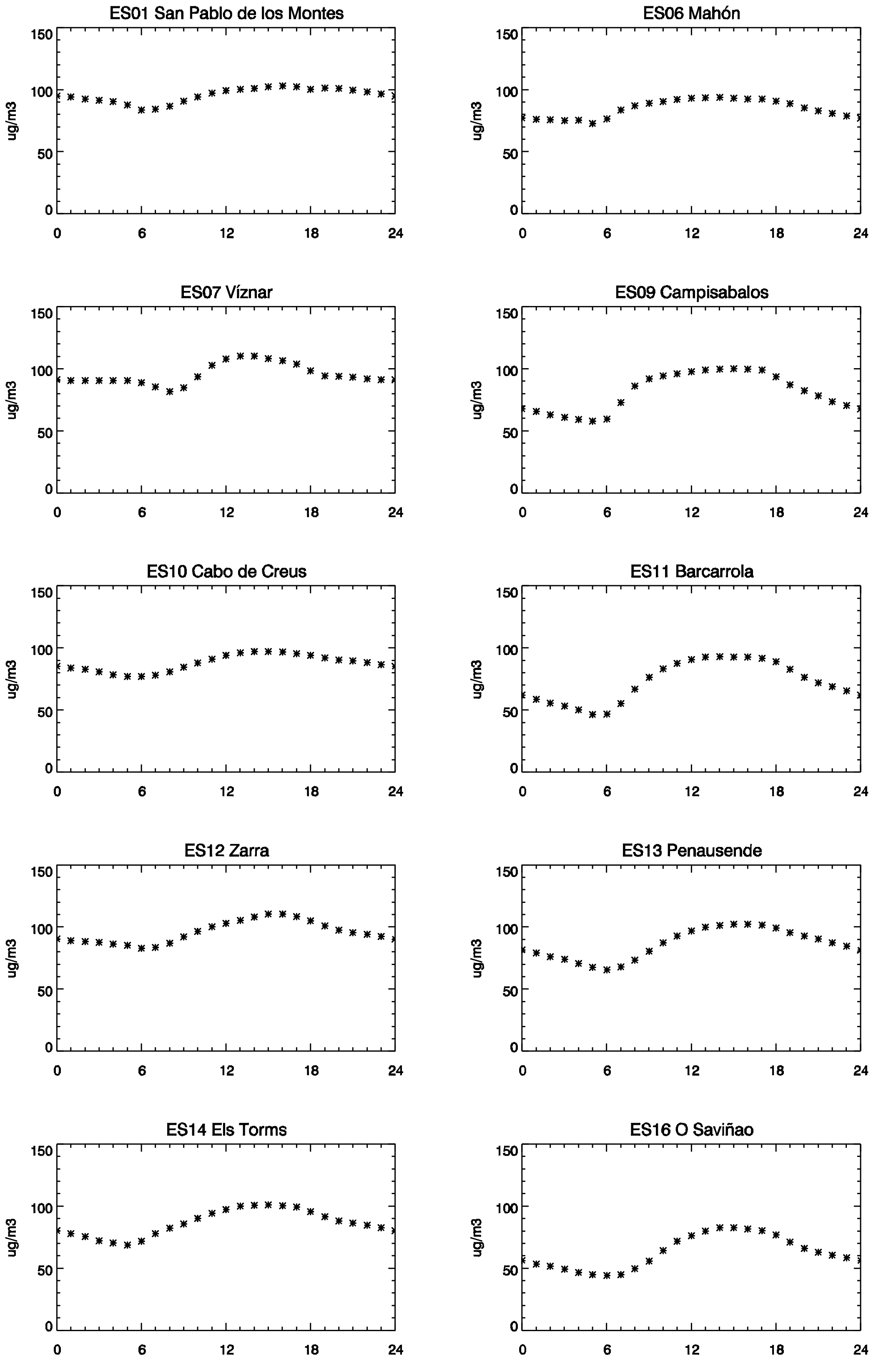

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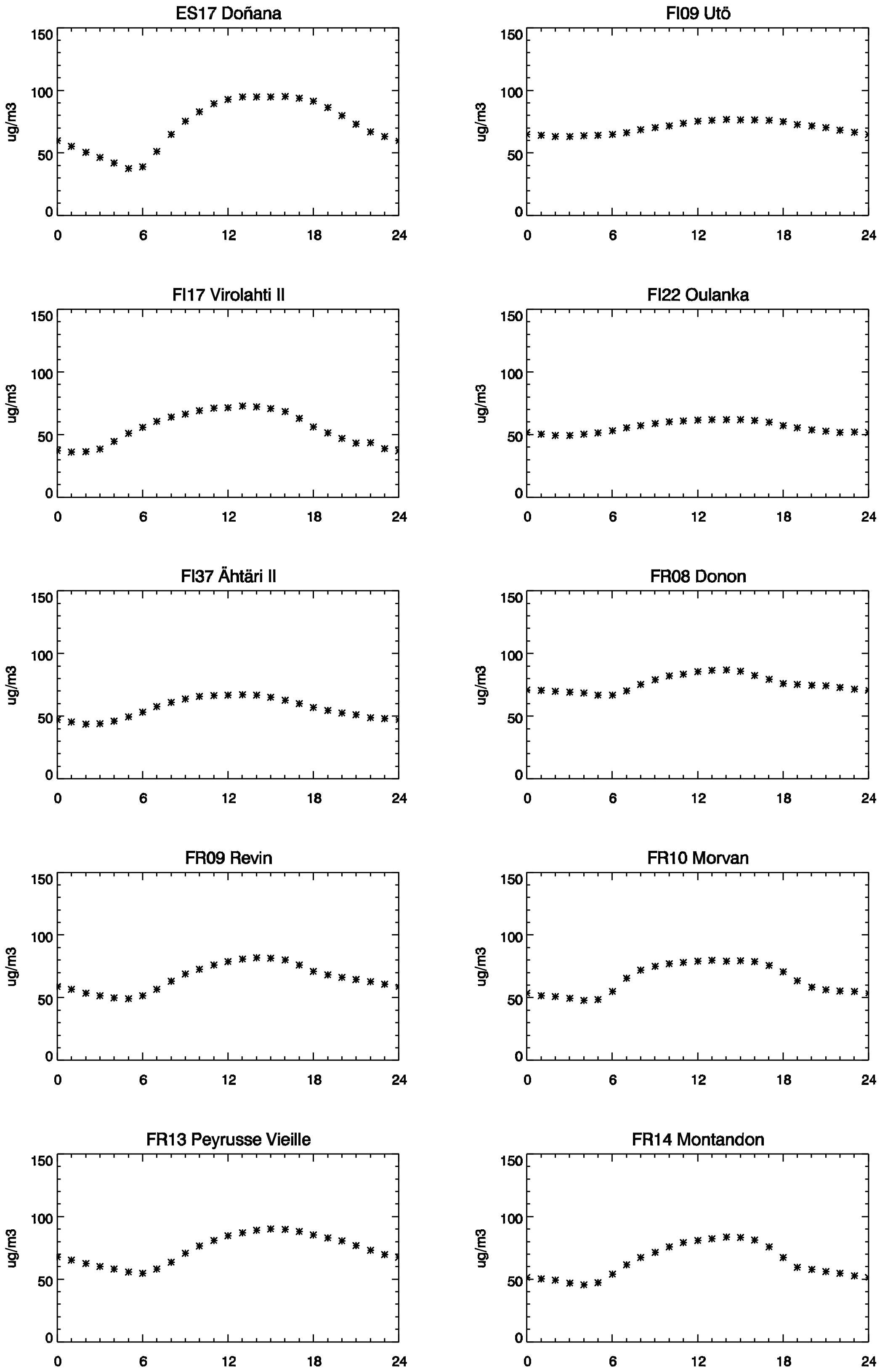

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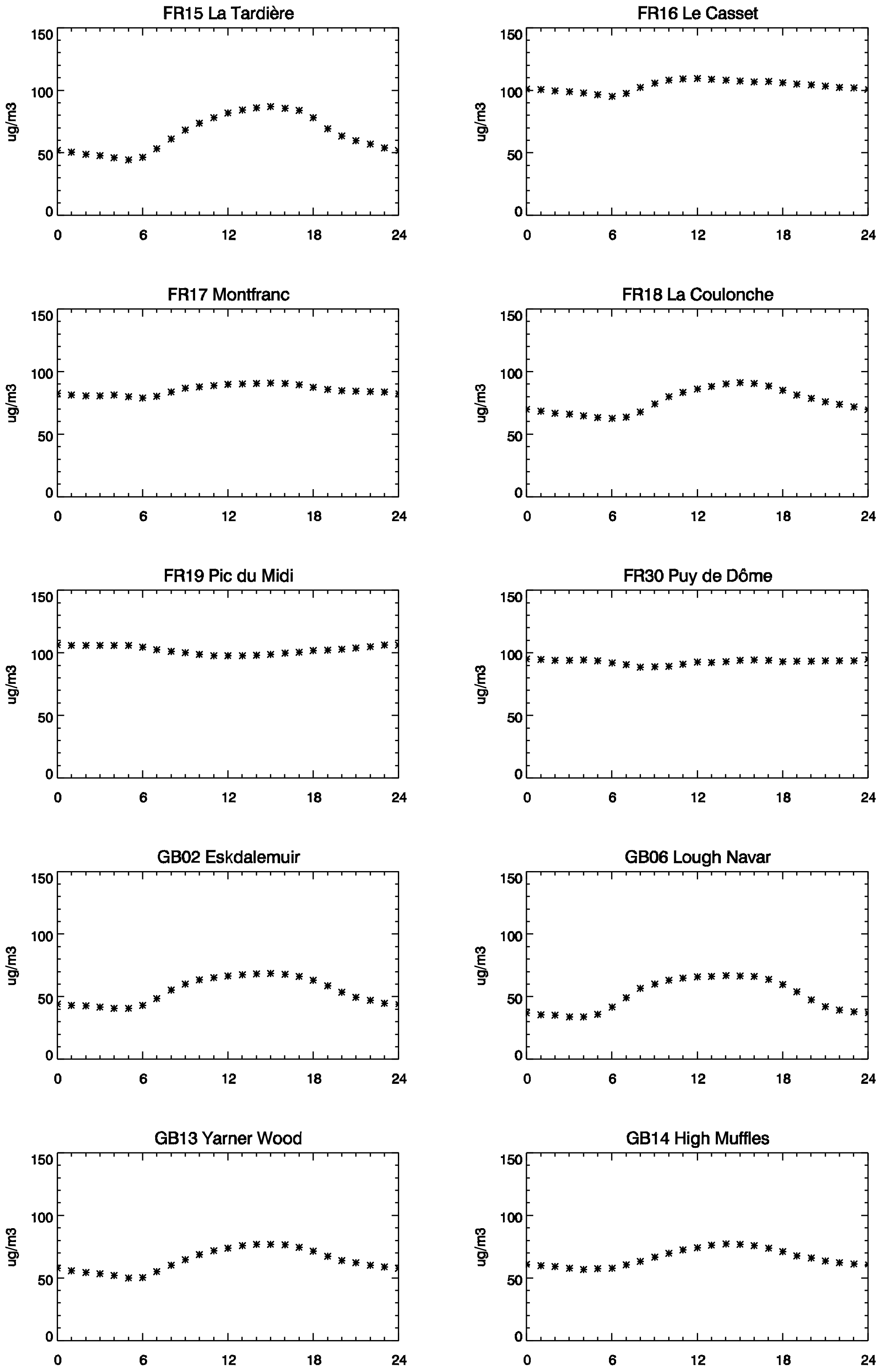

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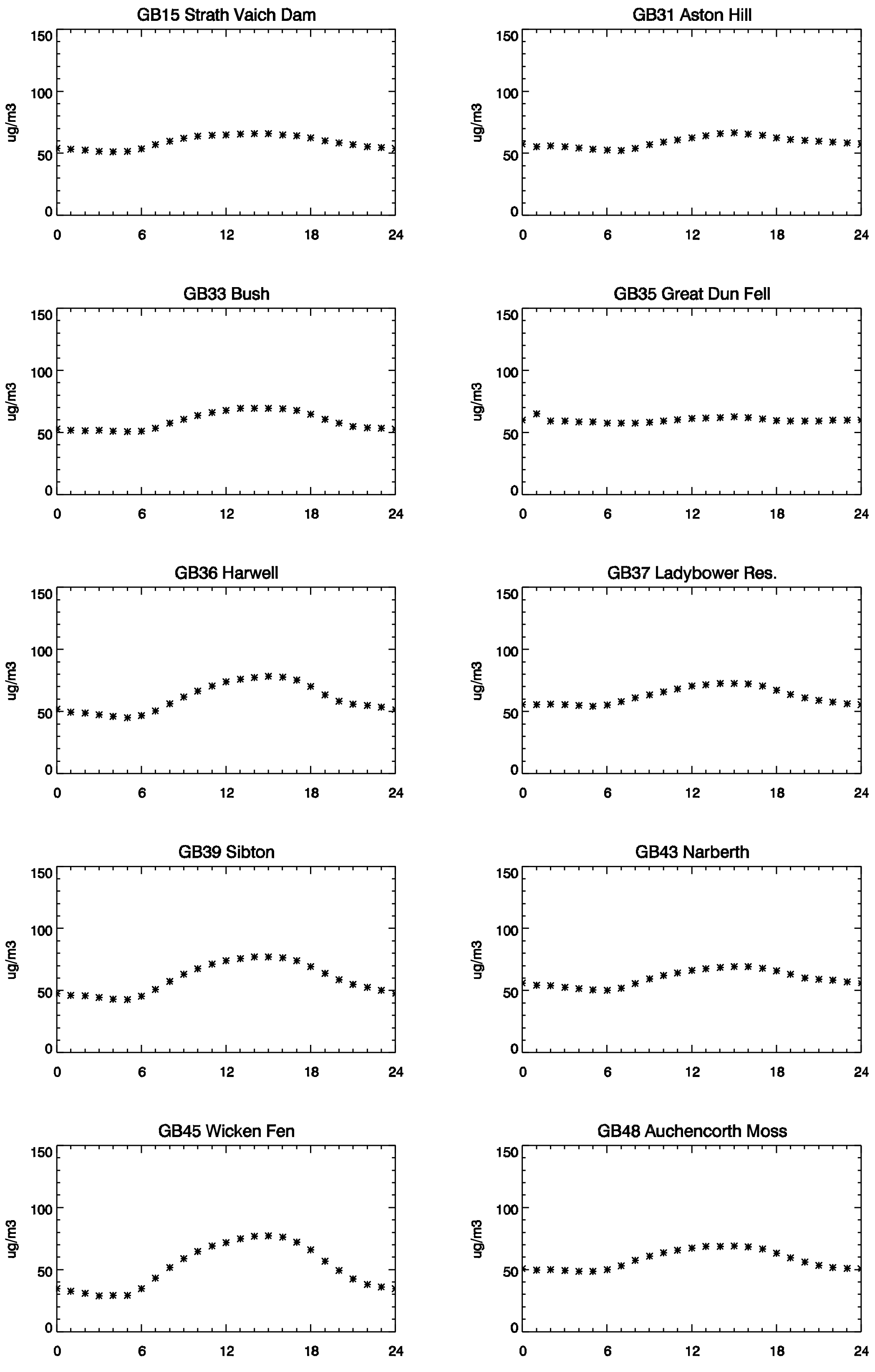

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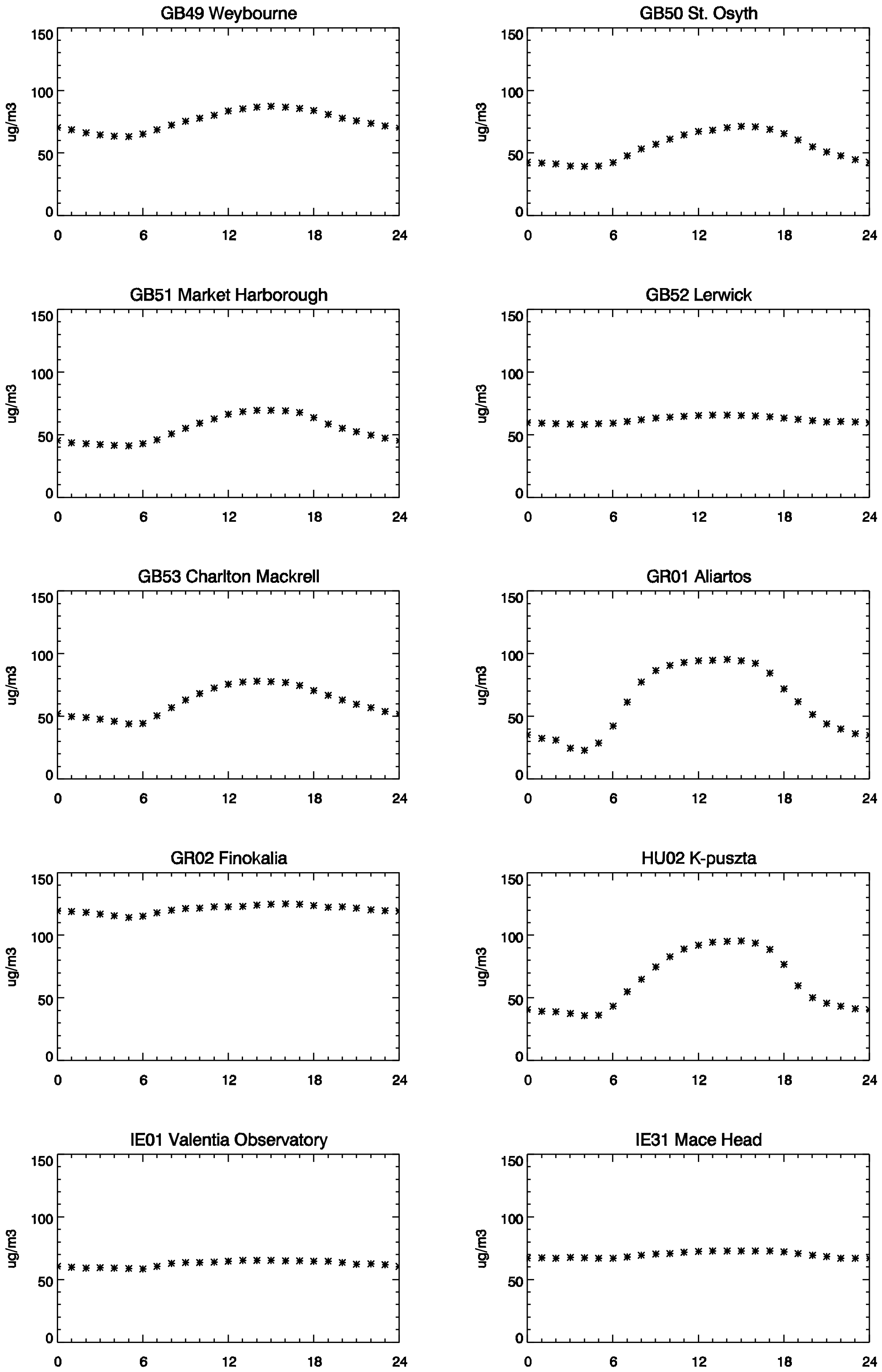

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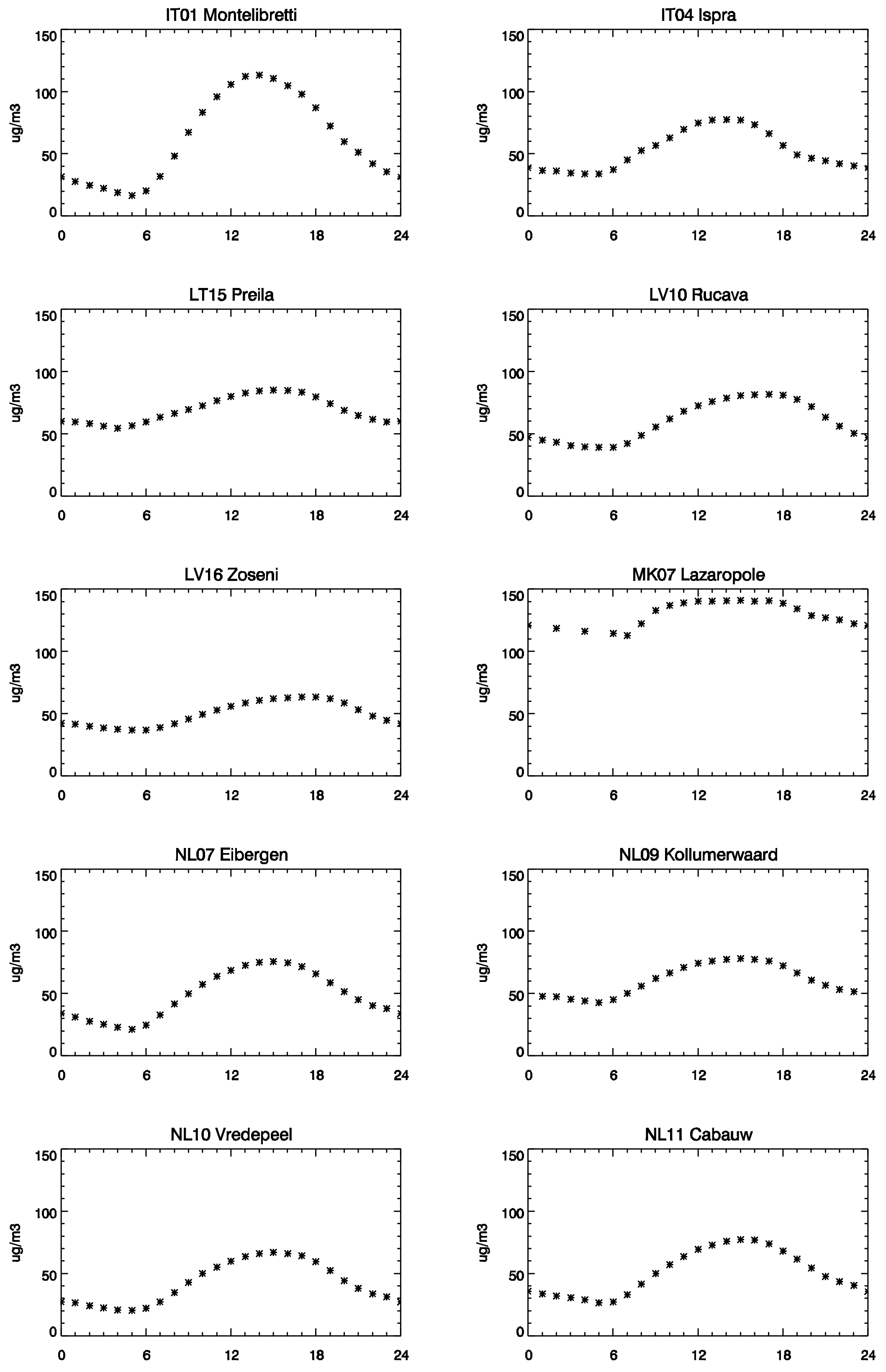

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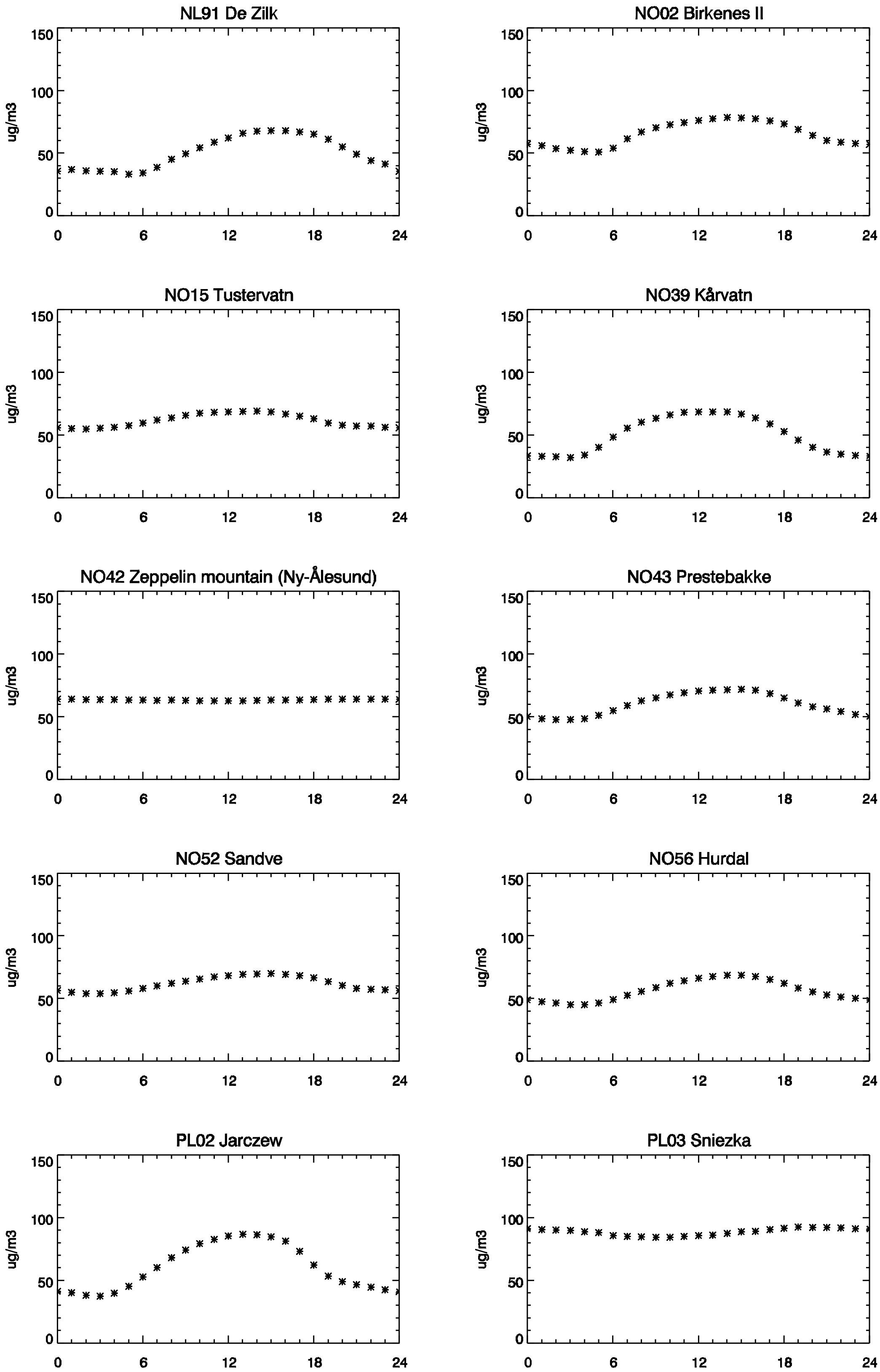

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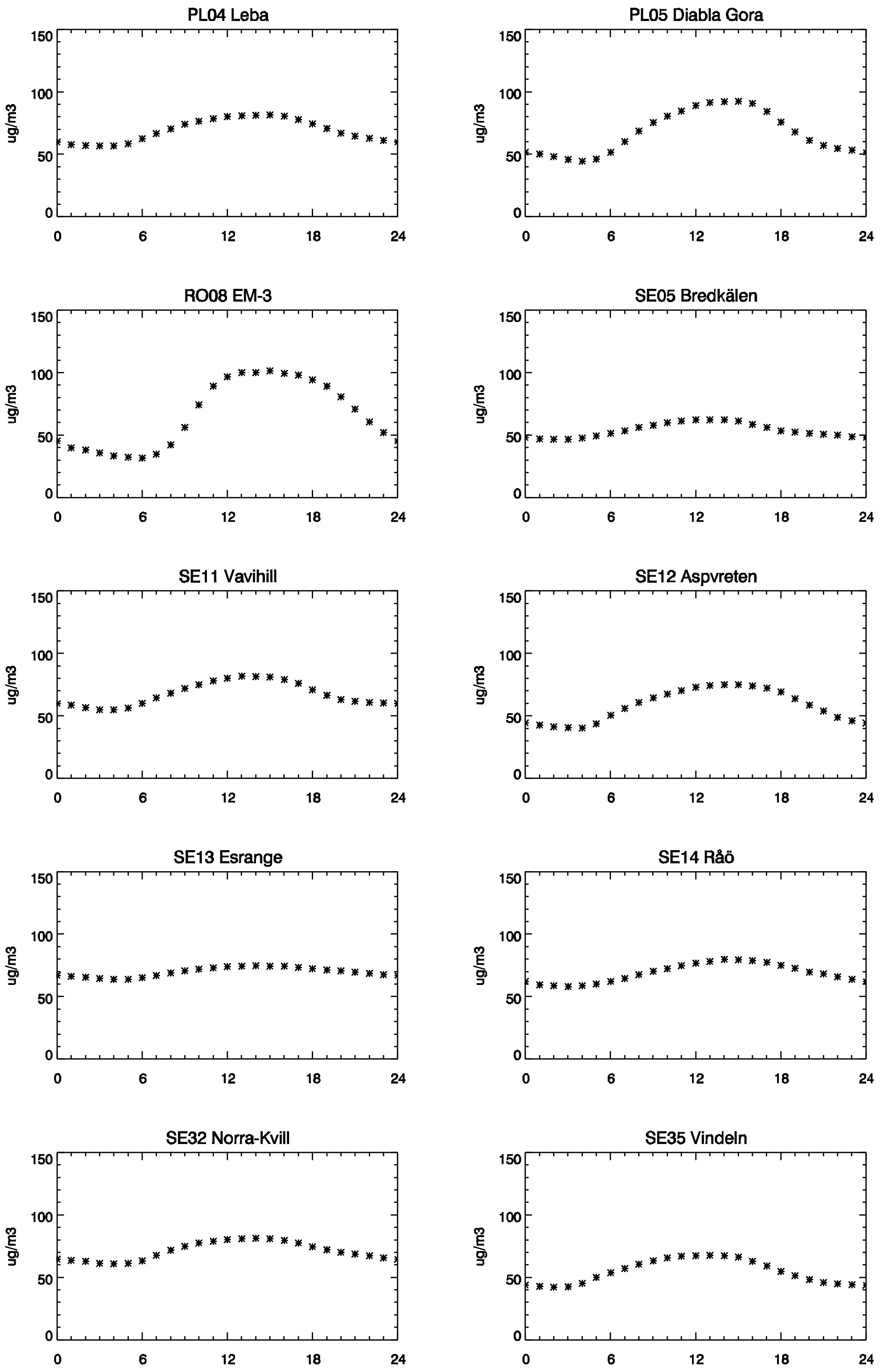

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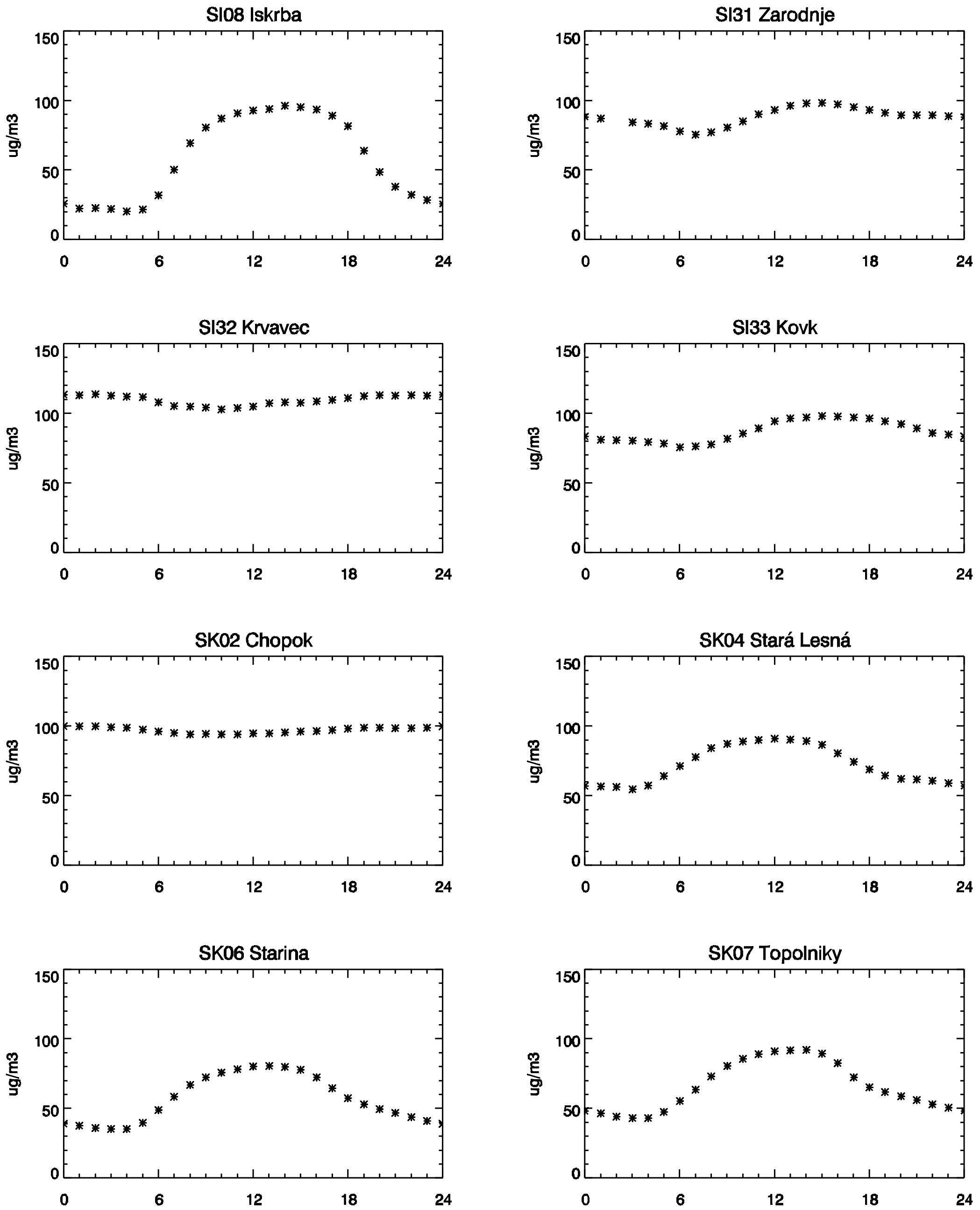

Figure 4.1, cont.

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.

Ozone measurements 1995.
EMEP/CCC-Report 3/97 by A.-G. Hjellbrekke.
Kjeller, Norwegian Institute for Air Research, 1997.

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EMEP/CCC-Report 3/98 by A.-G. Hjellbrekke.
Kjeller, Norwegian Institute for Air Research, 1998.

Ozone measurements 1997.
EMEP/CCC-Report 2/99 by A.-G. Hjellbrekke.
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EMEP/CCC-Report 5/2000 by A.-G. Hjellbrekke.
Kjeller, Norwegian Institute for Air Research, 2000.

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EMEP/CCC-Report 1/2001 by A.-G. Hjellbrekke and S. Solberg.
Kjeller, Norwegian Institute for Air Research, 2001.

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EMEP/CCC-Report 5/2002 by A.-G. Hjellbrekke and S. Solberg.
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.

Ozone measurements 2005.
EMEP/CCC-Report 2/2007 by A.M. Fjæraa and A.-G. Hjellbrekke.
Kjeller, Norwegian Institute for Air Research, 2007.

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.

Ozone measurements 2008.
EMEP/CCC-Report 2/2010 by A.M. Fjæraa and A.-G. Hjellbrekke.
Kjeller, Norwegian Institute for Air Research, 2010.

Ozone measurements 2009.
EMEP/CCC-Report 2/2011 by A.-G. Hjellbrekke, S. Solberg and A.M. Fjæraa.
Kjeller, Norwegian Institute for Air Research, 2011.

Ozone measurements 2010.
EMEP/CCC-Report 2/2012 by A.-G. Hjellbrekke, S. Solberg and A.M. Fjæraa.
Kjeller, Norwegian Institute for Air Research, 2012.