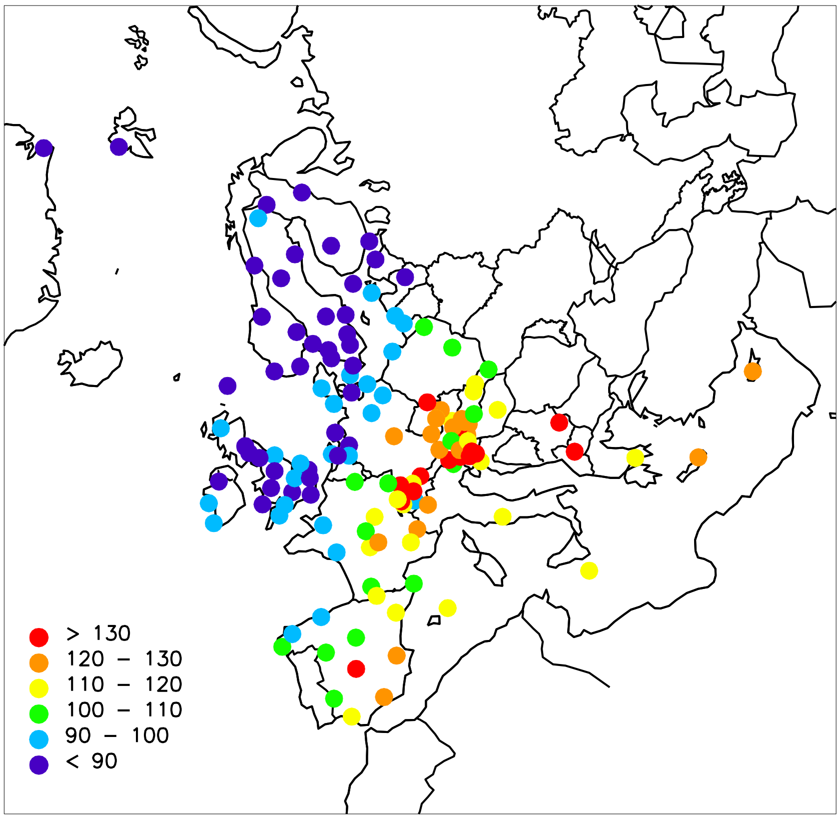
EMEP/CCC-Report 2/2017

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

Ozone measurements 2015

Anne-Gunn Hjellbrekke and Sverre Solberg



95-percentile
April-September, μg/m^3

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NILU
Norwegian Institute for Air Research
PO Box 100, NO-2027 Kjeller, Norway
Chemical Co-ordinating Centre of EMEP (CCC)

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1. Introduction

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

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

The EMEP ozone data from 2015 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 defined certain threshold levels for ozone. Within WHO these are called “air quality guidelines”, within EU “target value”, “long-term objective” etc. and within UN-ECE “critical levels”. The values of the various threshold levels vary among these organisations and, additionally, the health based indicators are normally based on concentration ($\mu g/m^3$) whereas those related to vegetation are based on mixing ratio (ppb). An overview of various levels relevant for vegetation and human health is given in Table 1 and Table 2, respectively.

Table 1: Limit values for the protection of vegetation.

AOT40 (ppb hours)	Period	Reference	Comment
3000	3 months	CLRTAP (2011)	Critical level for crops and natural vegetation [1)]
5000	1 April - 1 Oct	CLRTAP (2011)	Critical level for forest [1)]
6000	3.5 months	CLRTAP (2011)	Critical level for horticultural crops
9000	1 May – 1 Aug	EU (2008)	EU's target value for vegetation [2,3)]
3000	1 May - 1 Aug	EU (2008)	EU's long-term objective for vegetation [2,3)]

1) ECE's AOT values should be based on the hours with global incoming radiation > 50 W/m^2
2) EU's AOT values should be based on the period 08-20 CET
3) The EU directive uses µg/m^3 and a factor 2 µg/m^3 = 1 ppb

Table 2: Limit values for the protection of human health.

Value (µg/m^3)	Averaging time (hours)	Ref	Description
180	1	EU (2008)	EU's information threshold
240	1	EU (2008)	EU's alert threshold
120	8[1)]	EU (2008)	EU's target value. 8-hour mean value not to be exceeded on more than 25 days per year averaged over 3 years. To be fulfilled by 1.1.2010
120	8[1)]	EU (2008)	EU's long-term objective.
100	8[1)]	WHO (2006)	WHO's air quality guideline (global update 2005)

[1)] The highest 8-hour running mean value for each day calculated such that the 8-hour periods are assigned to the day on which the period ends.

Within UN-ECE scientific evidence has suggested that AOT40-based critical levels for vegetation (Gothenburg Protocol of 1999) should 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). 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.

The concentration-based critical level is 3000 ppbh (3-months period) for agricultural crops and (semi-)natural vegetation and 5000 ppbh (6-months period) for forest trees. The former critical level for forest was 10 000 ppbh, and the new, lower level is seen as a clear improvement compared to the former level (CLRTAP, 2011). 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.

Furthermore, the period for calculation of AOT40 should reflect the true growing season and should thus be adapted to the climate of the various regions in Europe, like specified in the Mapping Manual (CLRTAP, 2011). This leads to large differences in the applied period, from March-May in East Mediterranean to June-August in North Europe, which in turn has major consequences for the calculated AOT values. Since the aim of the present report is to document the general status of the ozone levels and not to provide any effect based calculations, the same 3-months period (May-July) is used for all stations. This also corresponds to the period stated in the EU directive. Moreover, no adjustment of the measured values to take the canopy height into account is done in this report. The measurement data are used directly.

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.

WHO has also defined certain air quality guidelines for the protection of human health and provided a global update of these levels including a new guideline for ground-level ozone in 2005 (WHO, 2006). Additionally, within both WHO, EU and UN-ECE the parameter SOMO35, defined as the sum of maximum 8-hour ozone levels over 35 ppb, is used as an indicator for health effects without any specified threshold level.

New flux-based critical levels for various types of vegetation have been approved for inclusion in LRTAP Convention's modelling and mapping manual (CLRTAP, 2011). 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.

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 2015 with emphasis on statistical summaries and geographical distributions. Earlier reports are listed in Annex 5.

Table 3 and Figure 1 show the location of the monitoring stations reporting data from whole or part of 2015. In total 133 stations from 27 different countries reported data. One of these sites (Ispra), is operated by the Commission of the European communities in Italy.

Table 3: List of EMEP ozone monitoring stations in operation 2015.

Code	Station name	Latitude	Longitude	Altitude
AT0002R	Illmitz	47°46'00"N	16°46'00"E	117
AT0005R	Vorhegg	46°40'40"N	12°58'20"E	1020
AT0030R	Pillersdorf bei Retz	48°43'16"N	15°56'32"E	315
AT0032R	Sulzberg	47°31'45"N	09°55'36"E	1020
AT0034G	Sonnblick	47°03'16"N	12°57'30"E	3106
AT0038R	Gerlitzen	46°41'37"N	13°54'54"E	1895
AT0040R	Masenberg	47°20'53"N	15°52'56"E	1170
AT0041R	Haunsberg	47°58'23"N	13°00'58"E	730
AT0043R	Forsthof	48°06'22"N	15°55'10"E	581
AT0045R	Dunkelsteinerwald	48°22'16"N	15°32'48"E	320
AT0046R	Gänserndorf	48°20'05"N	16°43'50"E	161
AT0047R	Stixneusiedl	48°03'03"N	16°40'36"E	240
AT0048R	Zoebelboden	47°50'19"N	14°26'29"E	899
AT0049R	Grebenzen bei St. Lamprecht	47°02'25"N	14°19'48"E	1648
AT0050R	Graz Lustbuehel	47°04'01"N	15°29'37"E	481
BE0001R	Offagne	49°52'40"N	05°12'13"E	430
BE0032R	Eupen	50°37'46"N	06°00'04"E	295
BE0035R	Vezin	50°30'12"N	04°59'22"E	160
BG0053R	Rojen peak	41°41'45"N	24°44'19"E	1750
CH0001G	Jungfraujoch	46°32'51"N	07°59'06"E	3578
CH0002R	Payerne	46°48'47"N	06°56'41"E	489
CH0003R	Tänikon	47°28'47"N	08°54'17"E	539
CH0004R	Chaumont	47°02'59"N	06°58'46"E	1137
CH0005R	Rigi	47°04'03"N	08°27'50"E	1031
CY0002R	Ayia Marina	35°02'21"N	33°03'29"E	532
CZ0001R	Svratouch	49°44'00"N	16°03'00"E	737
CZ0003R	Košetice (NOAK)	49°35'00"N	15°05'00"E	534
CZ0005R	Churanov	49°04'00"N	13°36'00"E	1118
CZ0007R	Kresin u Pacova	49°34'60"N	15°04'60"E	534
DE0001R	Westerland	54°55'32"N	08°18'35"E	12
DE0002R	Waldhof	52°48'08"N	10°45'34"E	74
DE0003R	Schauinsland	47°54'53"N	07°54'31"E	1205
DE0007R	Neuglobsow	53°10'00"N	13°02'00"E	62
DE0008R	Schmücke	50°39'00"N	10°46'00"E	937
DE0009R	Zingst	54°26'00"N	12°44'00"E	1
DK0005R	Keldsnor	54°44'47"N	10°44'10"E	10
DK0010G	Villum Research Station, Station Nord	81°36'00"N	16°40'12"W	20
DK0012R	Risoe	55°41'37"N	12°05'09"E	3
DK0031R	Ulborg	56°17'26"N	08°25'39"E	10

Table 3, cont.

Code	Station name	Latitude	Longitude	Altitude
EE0009R	Lahemaa	59°30'00"N	25°54'00"E	32
EE0011R	Vilsandi	58°23'00"N	21°49'00"E	6
ES0001R	San Pablo de los Montes	39°32'52"N	04°20'55"W	917
ES0005R	Noya	42°43'41"N	05°55'25"W	683
ES0006R	Mahón	39°52'00"N	04°19'00"E	78
ES0007R	Víznar	37°14'00"N	03°32'00"W	1265
ES0008R	Niembro	43°26'32"N	04°51'01"W	134
ES0009R	Campisábalos	41°16'52"N	03°08'34"W	1360
ES0010R	Cabo de Creus	42°19'10"N	03°19'01"E	23
ES0011R	Barcarrota	38°28'33"N	06°55'22"W	393
ES0012R	Zarra	39°05'10"N	01°06'07"W	885
ES0013R	Penausende	41°17'00"N	05°52'00"W	985
ES0014R	Els Torms	41°24'00"N	00°43'00"E	470
ES0016R	O Saviñao	43°13'52"N	07°41'59"W	506
ES0017R	Doñana	37°01'50"N	06°19'55"W	5
FI0009R	Utö	59°46'45"N	21°22'38"E	7
FI0018R	Virolahti III	60°31'48"N	27°40'03"E	4
FI0022R	Oulanka	66°19'13"N	29°24'06"E	310
FI0037R	Ähtäri II	62°35'00"N	24°11'00"E	180
FI0096G	Pallas (Sammaltunturi)	68°00'00"N	24°09'00"E	340
FR0008R	Donon	48°30'00"N	07°08'00"E	775
FR0009R	Revin	49°54'00"N	04°38'00"E	390
FR0010R	Morvan	47°16'00"N	04°05'00"E	620
FR0013R	Peyrusse Vieille	43°37'00"N	00°11'00"E	200
FR0014R	Montandon	47°18'00"N	06°50'00"E	836
FR0015R	La Tardière	46°39'00"N	00°45'00"W	133
FR0016R	Le Casset	45°00'00"N	06°28'00"E	1750
FR0017R	Montfranc	45°48'00"N	02°04'00"E	810
FR0018R	La Coulonche	48°38'00"N	00°27'00"W	309
FR0019R	Pic du Midi	42°56'12"N	00°08'31"E	2877
FR0023R	Saint-Nazaire-le-Désert	44°34'10"N	05°16'44"E	605
FR0025R	Verneuil	46°48'53"N	02°36'36"E	182
FR0030R	Puy de Dôme	45°46'00"N	02°57'00"E	1465
GB0002R	Eskdalemuir	55°18'47"N	03°12'15"W	243
GB0006R	Lough Navar	54°26'35"N	07°52'12"W	126
GB0013R	Yarner Wood	50°35'47"N	03°42'47"W	119
GB0014R	High Muffles	54°20'04"N	00°48'27"W	267
GB0015R	Strath Vaich Dam	57°44'04"N	04°46'28"W	270
GB0031R	Aston Hill	52°30'14"N	03°01'59"W	370
GB0033R	Bush	55°51'31"N	03°12'18"W	180
GB0035R	Great Dun Fell	54°41'00"N	02°27'00"W	847
GB0036R	Harwell	51°34'23"N	01°19'00"W	137
GB0037R	Ladybower Res.	53°23'56"N	01°45'12"W	420
GB0038R	Lullington Heath	50°47'34"N	00°10'46"E	120
GB0039R	Sibton	52°17'38"N	01°27'47"E	46
GB0043R	Narberth	51°14'00"N	04°42'00"W	160
GB0045R	Wicken Fen	52°17'54"N	00°17'34"W	5
GB0048R	Auchencorth Moss	55°47'32"N	03°14'34"W	260
GB0049R	Weybourne	52°57'02"N	01°07'19"E	16
GB0050R	St. Osyth	51°46'41"N	01°04'56"E	8
GB0053R	Charlton Mackrell	51°03'23"N	02°41'00"W	54
GR0001R	Aliartos	38°22'00"N	23°05'00"E	110
GR0002R	Finokalia	35°19'00"N	25°40'00"E	250
HU0002R	K-puszta	46°58'00"N	19°35'00"E	125
IE0001R	Valentia Observatory	51°56'23"N	10°14'40"W	11
IE0031R	Mace Head	53°10'00"N	09°30'00"W	15
IT0001R	Montelibretti	42°06'00"N	12°38'00"E	48
IT0004R	Ispra	45°48'00"N	08°38'00"E	209
LT0015R	Preila	55°21'00"N	21°04'00"E	5
LV0010R	Rucava	56°09'43"N	21°10'23"E	18
LV0016R	Zoseni	57°08'07"N	25°54'20"E	188
MK0007R	Lazaropole	41°32'10"N	20°41'38"E	1332
MT0001R	Giordan lighthouse	36°04'24"N	14°13'09"E	167
NL0007R	Eibergen	52°05'00"N	06°34'00"E	20
NL0009R	Kollumerwaard	53°20'02"N	06°16'38"E	1
NL0010R	Vredepeel	51°32'28"N	05°51'13"E	28

Table 3, cont.

Code	Station name	Latitude	Longitude	Altitude
NL0091R	De Zilk	52°18'00"N	04°30'00"E	4
NL0644R	Cabauw Wielsekade	51°58'28"N	04°55'25"E	1
NO0002R	Birkenes II	58°23'19"N	08°15'07"E	219
NO0015R	Tustervatn	65°50'00"N	13°55'00"E	439
NO0039R	Kårvatn	62°47'00"N	08°53'00"E	210
NO0042G	Zeppelin mountain (Ny-Ålesund)	78°54'24"N	11°53'18"E	474
NO0043R	Prestebakke	59°00'00"N	11°32'00"E	160
NO0052R	Sandve	59°12'00"N	05°12'00"E	15
NO0056R	Hurdal	60°22'21"N	11°04'41"E	300
PL0002R	Jarczew	51°49'00"N	21°59'00"E	180
PL0003R	Sniezka	50°44'00"N	15°44'00"E	1603
PL0004R	Leba	54°45'00"N	17°32'00"E	2
PL0005R	Diabla Gora	54°09'00"N	22°04'00"E	157
RS0005R	Kamenici Vis	43°24'00"N	21°57'00"E	813
SE0005R	Bredkälen	63°51'00"N	15°20'00"E	404
SE0011R	Vavihill	56°01'00"N	13°09'00"E	175
SE0012R	Aspvreten	58°48'00"N	17°23'00"E	20
SE0013R	Esrange	67°53'00"N	21°04'00"E	475
SE0014R	Råö	57°23'38"N	11°54'50"E	5
SE0018R	Asa	57°09'52"N	014°46'57"E	180
SE0019R	Östad	57°57'09"N	012°24'11"E	65
SE0032R	Norra-Kvill	57°49'00"N	15°34'00"E	261
SE0035R	Vindeln	64°15'00"N	19°46'00"E	225
SE0039R	Grimsö	59°43'41"N	15°28'19"E	132
SI0008R	Iskrba	45°34'00"N	14°52'00"E	520
SI0031R	Zarodnje	46°25'43"N	15°00'12"E	770
SI0032R	Krvavec	46°17'58"N	14°32'19"E	1740
SI0033R	Kovk	46°07'43"N	15°06'50"E	600
SK0002R	Chopok	48°56'00"N	19°35'00"E	2008
SK0004R	Stará Lesná	49°09'00"N	20°17'00"E	808
SK0006R	Starina	49°03'00"N	22°16'00"E	345
SK0007R	Topolniky	47°57'36"N	17°51'38"E	113

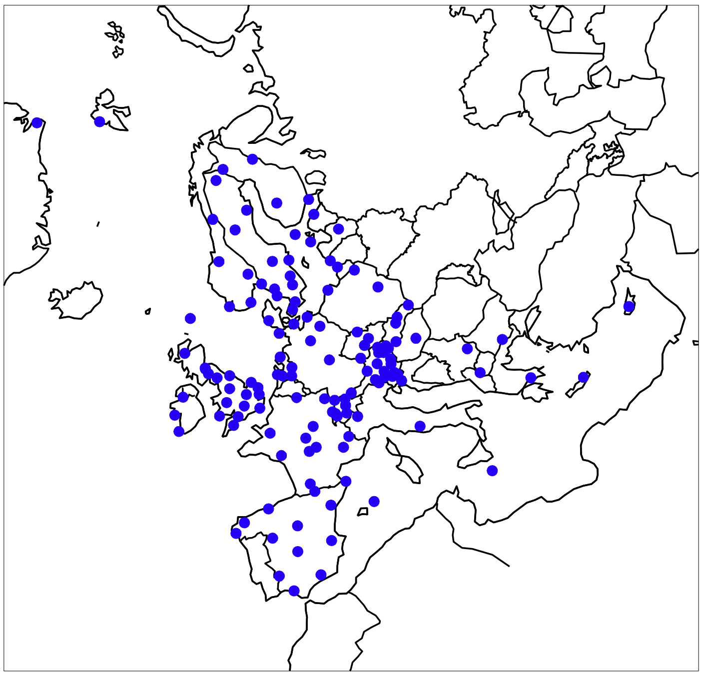

Figure 1: Location of the monitoring stations.

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. 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 ozone section 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 2015.

All data presented in this report are given in µg/m^3. The conversion factor used to calculate from nmol/mol to µg/m^3 is given in Table 4. Most countries use a conversion factor of 2.0, which corresponds to 20°C and 1013 hPa. For Jungfraujoch in Switzerland, the mean annual conditions (-8°C, 653 mbar) are used, giving a conversion factor of 1.42. A number of countries report ozone data in nmol/mol, and in this case the data are converted to µg/m^3 by multiplying by 2.0 at the CCC.

Table 4: Conversion factor ppb – µg/m^3.

Country	Conversion factor
Austria	reported in nmol/mol
Belgium	2.0
Bulgaria	
Cyprus	2.0
Czech Republic	2.0
Denmark	2.0
Estonia	2.0
Finland	2.0
France	2.0
Germany	2.0
Greece (Aliartos)	1.96
Greece (Finokalia)	reported in nmol/mol
Hungary	2.0
Ireland (Mace Head)	reported in nmol/mol
Italy (Ispra)	reported in nmol/mol
Italy (Montelibretti)	reported in nmol/mol
Latvia	2.0
Lithuania	2.0
Malta	reported in nmol/mol
Netherlands	2.0
Norway	2.0
Poland	2.0
Slovakia	2.0
Slovenia	2.0/reported in nmol/mol
Spain	2.0
Sweden	2.0
Switzerland	2.0 (1.42 at CH0001R)
United Kingdom	reported in nmol/mol

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 5. The data capture is in general good. 115 stations have a data capture above 90% and 119 above 85%.

Table 5: Data capture in per cent, 2015.

Code	Station	Data capture 2015
AT0002R	Illmitz	93.1
AT0005R	Vorhegg	95.2
AT0030R	Pillersdorf bei Retz	94.8
AT0032R	Sulzberg	95.5
AT0034G	Sonnblick	84.4
AT0038R	Gerlitzen	94.8
AT0040R	Masenberg	95.5
AT0041R	Haunsberg	91.9
AT0043R	Forsthof	95.1
AT0045R	Dunkelsteinerwald	95.1
AT0046R	Gänserndorf	94.6
AT0047R	Stixneusiedl	95.5
AT0048R	Zoebelboden	95.2
AT0049R	Grebenzen bei St. Lamprecht	95.3
AT0050R	Graz Lustbuehel	95.5
BG0053R	Rojen peak	79.7
CH0001G	Jungfraujoch	96.8
CH0002R	Payerne	99
CH0003R	Tänikon	99.3
CH0004R	Chaumont	98.9
CH0005R	Rigi	99.3
CY0002R	Ayia Marina	96.6
CZ0001R	Svratouch	93
CZ0003R	Kosetice	96.2
CZ0003R	Kosetice	89.8
CZ0005R	Churanov	97.7
DE0001R	Westerland	95.4
DE0002R	Waldhof	95.5
DE0003R	Schauinsland	74
DE0007R	Neuglobsow	93
DE0008R	Schmücke	94.7
DE0009R	Zingst	93.7
DK0005R	Keldsnor	87.9
DK0010G	Villum Research Station, Station Nord	64.3
DK0012R	Risoe	82.8
DK0031R	Ulborg	88.3
EE0009R	Lahemaa	99.8
EE0011R	Vilsandi	97.6

Table 5, cont.

Code	Station	Data capture 2015
ES0001R	San Pablo de los Montes	99
ES0005R	Noya	94.9
ES0006R	Mahón	97.5
ES0007R	Víznar	94.9
ES0008R	Niembro	97.8
ES0009R	Campisabalos	98.1
ES0010R	Cabo de Creus	94.3
ES0011R	Barcarrota	95
ES0012R	Zarra	98.6
ES0013R	Penausende	97.5
ES0014R	Els Torms	98.2
ES0016R	O Saviñao	96.5
ES0017R	Doñana	98.8
FI0009R	Utö	99.3
FI0018R	Virolahti III	98.7
FI0022R	Oulanka	99.5
FI0037R	Ähtäri II	96.9
FI0096G	Pallas (Sammaltunturi)	99.4
FR0008R	Donon	99.7
FR0009R	Revin	97.6
FR0010R	Morvan	92.1
FR0013R	Peyrusse Vieille	92.2
FR0014R	Montandon	98.4
FR0015R	La Tardière	94.6
FR0016R	Le Casset	97.3
FR0017R	Montfranc	98.8
FR0018R	La Coulonche	98.1
FR0019R	Pic du Midi	99.4
FR0023R	Saint-Nazaire-le-Désert	95
FR0025R	Verneuil	99.1
FR0030R	Puy de Dôme	93.8
GB0002R	Eskdalemuir	99.1
GB0006R	Lough Navar	98.9
GB0013R	Yarner Wood	98.2
GB0014R	High Muffles	92.4
GB0015R	Strath Vaich Dam	98.7
GB0031R	Aston Hill	98.2
GB0033R	Bush	99.3
GB0035R	Great Dun Fell	79.2
GB0036R	Harwell	98.1
GB0038R	Lullington Heath	98.6
GB0039R	Sibton	99.8
GB0043R	Narberth	98.9
GB0045R	Wicken Fen	99
GB0048R	Auchencorth Moss	99
GB0049R	Weybourne	99.9
GB0050R	St. Osyth	93.6
GB0052R	Lerwick	91.7
GB0053R	Charlton Mackrell	99.8
GR0001R	Aliartos	94.3
GR0002R	Finokalia	92.4
HU0002R	K-puszta	79.3

Table 5, cont.

Code	Station	Data capture 2015
IE0001R	Valentia Observatory	99.9
IE0031R	Mace Head	100
IT0001R	Montelibretti	84.4
IT0004R	Ispra	91.1
LT0015R	Preila	97
LV0010R	Rucava	85.9
LV0016R	Zoseni	97.6
MK0007R	Lazaropole	80
MT0001R	Giordan lighthouse	92.6
NL0007R	Eibergen	97.1
NL0009R	Kollumerwaard	97.9
NL0010R	Vredepeel	96.8
NL0091R	De Zilk	97.8
NL0644R	Cabauw Wielsekade	97.3
NO0002R	Birkenes II	99.3
NO0015R	Tustervatn	91.6
NO0039R	Kårvatn	98
NO0042G	Zeppelin mountain (Ny-Ålesund)	99.5
NO0043R	Prestebakke	99.6
NO0052R	Sandve	93.4
NO0056R	Hurdal	94.9
PL0002R	Jarczew	99.9
PL0003R	Sniezka	99.6
PL0004R	Leba	99.6
PL0005R	Diabla Gora	99.7
RS0005R	Kamenicki vis	73
SE0005R	Bredkälen	99.7
SE0011R	Vavihill	99.2
SE0012R	Aspvreten	94.2
SE0013R	Esrange	99.8
SE0014R	Råö	99
SE0018R	Asa	98.4
SE0019R	Östad	99.8
SE0032R	Norra-Kvill	99.8
SE0035R	Vindeln	99.7
SE0039R	Grimsö	99.7
SI0008R	Iskrba	95.3
SI0031R	Zarodnje	94.8
SI0032R	Krvavec	93.8
SI0033R	Kovk	79
SK0002R	Chopok	62.2
SK0004R	Stará Lesná	62.2
SK0006R	Starina	54.8
SK0007R	Topolniky	62.1

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% is required and an adjustment proportional to the number of missing data is 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 number of ozone exceedances was slightly higher in 2015 compared to the previous five years (Figure 2). 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 2015 was measured at Ispra in Italy (255 µg/m^3, July 15) (Table 1.1, Annex 1). In total concentrations above 200 µg/m^3 were measured at 15 sites in Central Europe. This is considerably higher than in 2014, where the highest maximum was below 200 µg/m^3. The lowest maximum concentrations were measured at Villum research station in Greenland (94 µg/m^3) and Vindelen in Sweden (99 µg/m^3).

Exceedances of the information threshold of 180 µg/m^3 were observed at 33 sites, compared to seven sites in 2014 and 24 sites in 2013. The unusual warm summers of 2003 and 2006 had 81 and 69 exceedances respectively.

Table 1.2 in Annex 1 shows the 25-, 50-, 75-, 90-, 95-, 98- and 99-percentiles for the period April-September. Graphical distributions of the 99-percentiles and 95-percentiles for stations with data capture higher than 75% are shown in Figure 1.1 and 1.2 in Annex 1. The lowest values are found in Norway, Finland and United Kingdom, where the 99-percentiles are below 110 µg/m^3. The concentrations are higher in Denmark, Sweden and the Baltics, where the 99-percentiles generally ranges from 110-130 µg/m^3, and at its highest in Switzerland and Austria where the 99-percentile values are above 150 µg/m^3.

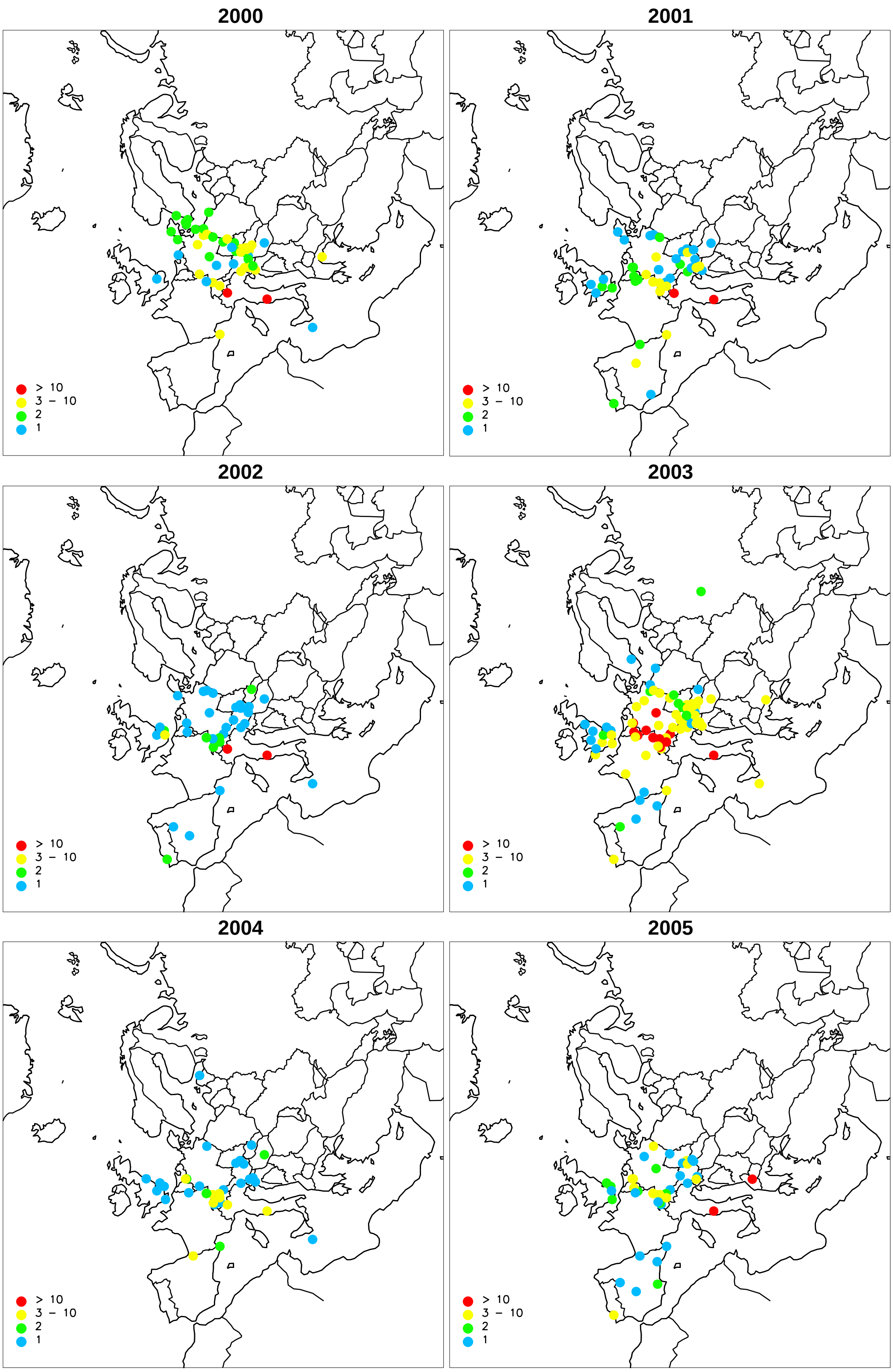

Figure 2: Number of exceedances of the threshold value of 180 $\mu g/m^3$ 2000-2015. (Unit: number of days.) Stations with zero exceedances are not shown.

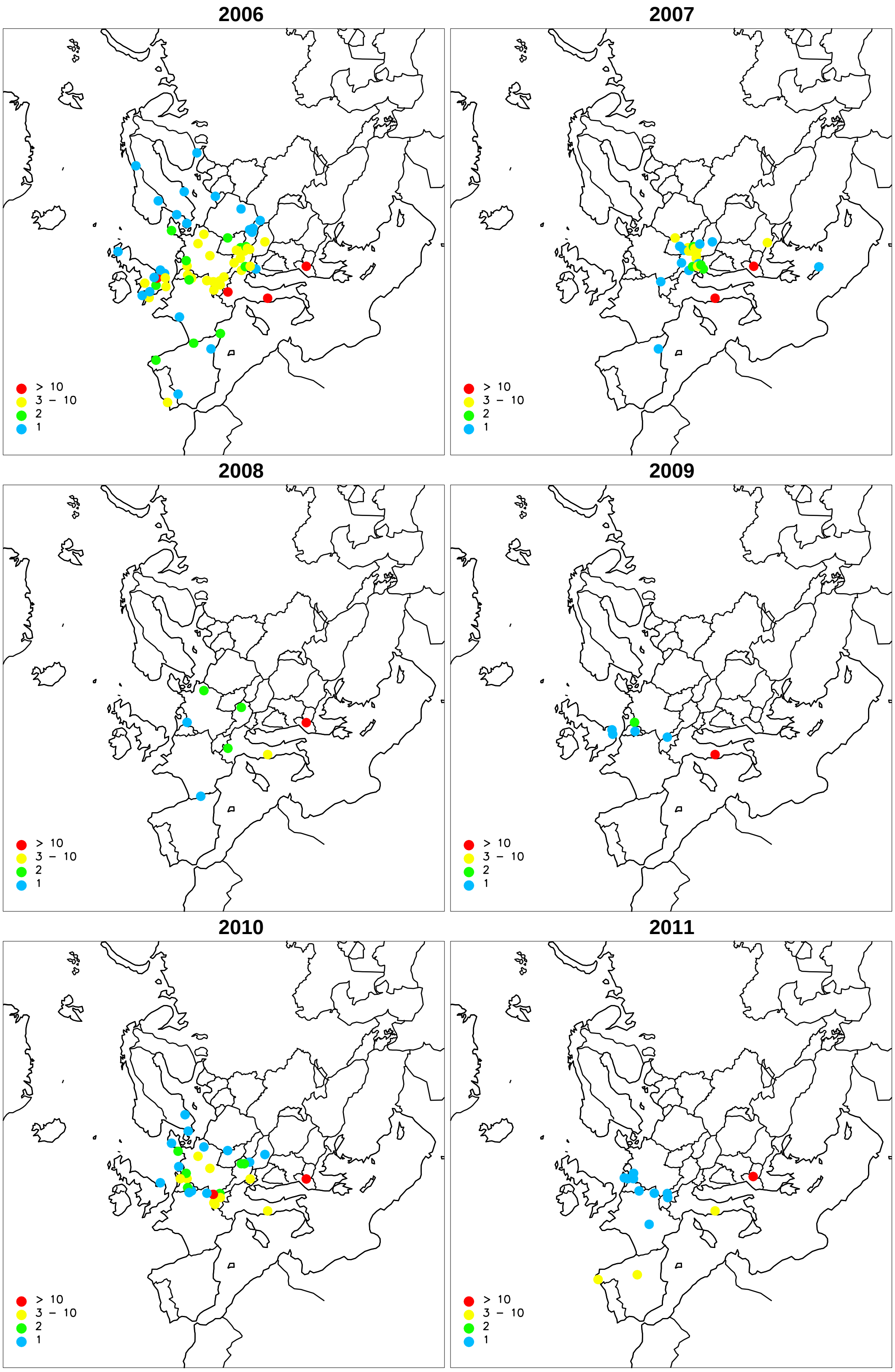

Figure 2, cont.

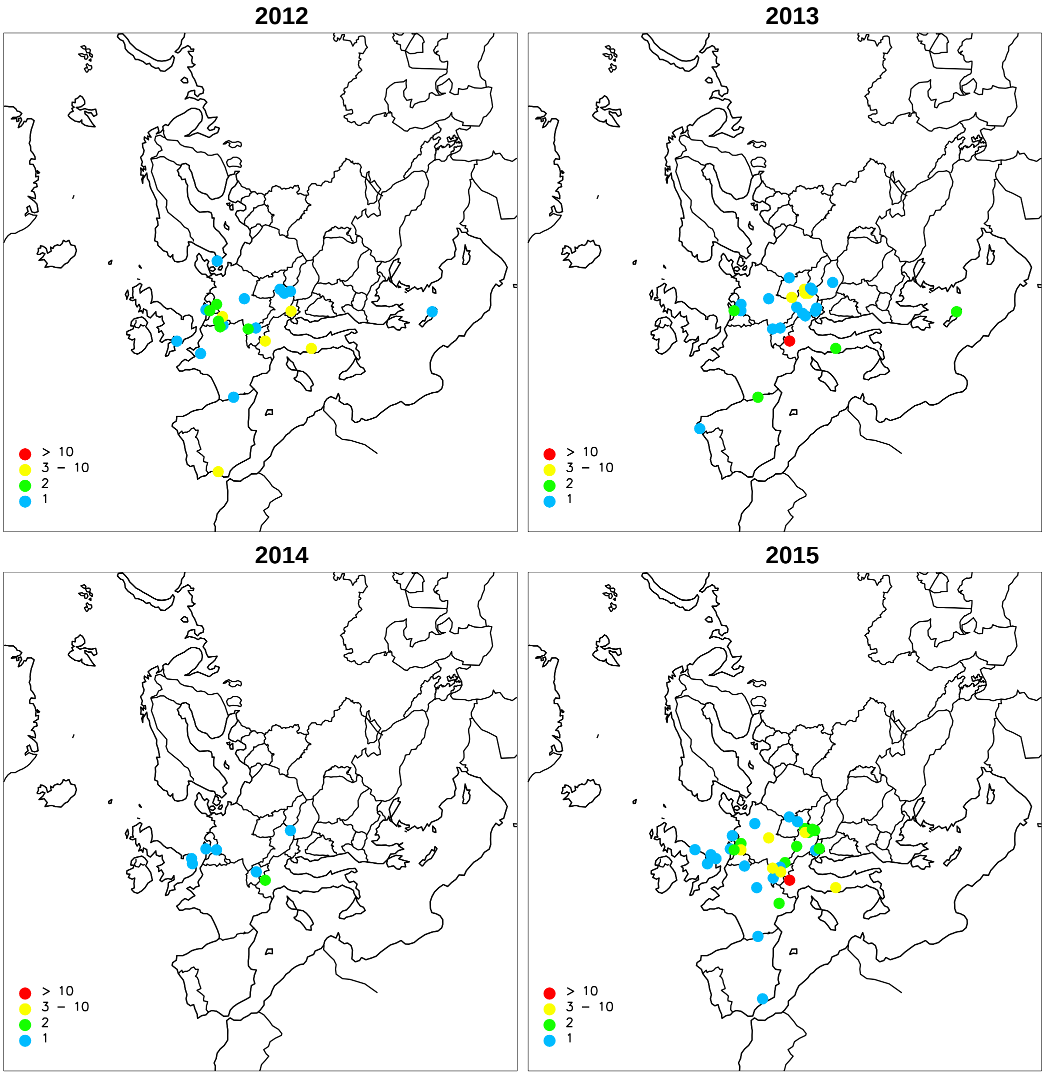

Figure 2, cont.

6. Calculation of AOT40

AOT40 for forest and agricultural crops for 2015 are shown in Table 2.1 in Annex 2, and the corresponding geographical distributions of AOT40 are shown in Figure 2.1–2.2. AOT values are calculated using daylight hours only, based on an estimated global radiation above 50 W/m^2 assuming clear skies. 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. Three sites in Europe (Austria, Greece and Macedonia) had AOT40 (May-July) values above 15 000 ppbh. The critical level for forest (5 000 ppbh) was exceeded at most sites in Central, Eastern and Southern Europe.

7. Seasonal variation

Monthly mean concentrations and data capture for 2015 are given in Table 3.1 (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 1990-2015 are given in Figure 3.1 in Annex 3. The seasonal variation of ozone shows characteristics, which seem to be bound by the geographical location of the station (Roemer et al., 1996). In Central and Alpine Europe the variation is characterised by a broad summer maximum with high monthly means from May to August. A springtime maximum in April and May followed by a gradual decline to a minimum in November-December is found for sites in England, the Netherlands and the southern parts of Scandinavia and Finland. A spring maximum followed by a minimum in the summer is generally found in Ireland, Scotland and the northern parts of Scandinavia and Finland.

8. Diurnal variation

In addition to the seasonal variation, ozone concentrations show a variation on a shorter time scale. The average diurnal variation of surface ozone for summer (April-September) 2015 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 the diurnal cycle of the mixing height and photochemical generation of ozone during daytime. During the night, more stable atmospheric conditions and nocturnal inversions prevent the vertical mixing and the transport of ozone from the free troposphere into the boundary layer. A weaker diurnal variation is observed at the coastal and island stations and at the remote sites in Norway and Sweden. Mace Head, situated on the west coast of Ireland, has roughly the same average concentrations as the rural sites in Central Europe but almost no diurnal variation due to remoteness from source areas and prevailing westerly winds. Zeppelinfjellet at Spitsbergen shows no diurnal variation. Elevated sites like Chaumont and Krvavec show a weaker diurnal cycle and the average concentration level is also high, due to influence of air from the free troposphere.

9. Update

The data compiled in this report represent the quality assured and quality controlled data at present. If errors are detected in the future, the data will be corrected in the database. It is important that users make certain they have access to the most recent version of the data. For the data presented here, the latest alteration was August 16th, 2017.

All EMEP measurement data can be downloaded online at http://ebas.nilu.no or sent upon request to annehj@nilu.no. Information on EMEP and the measurement network are available at http://www.emep.int and http://www.nilu.no/projects/ccc.

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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 Berit Modalen. Ann Mari Fjæraa, 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	Department of Environmental Science, Aarhus University
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
Ireland	Environmental Protection Agency (EPA) Ricardo – AEA
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	Slovenian Environment Agency
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	Ricardo – AEA

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 2015.

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	8159	362	471	74	86	19	7	2	0	0	198.1	2015-08-13
AT0005R	Vorhegg	8340	365	196	35	2	1	0	0	0	0	151.4	2015-07-16
AT0030R	Pillersdorf bei Retz	8307	365	365	48	72	19	5	2	0	0	196.1	2015-07-07
AT0032R	Sulzberg	8365	365	912	77	181	25	4	2	0	0	186	2015-08-12
AT0034G	Sonnblick	7391	346	1322	123	102	20	0	0	0	0	170.3	2015-08-31
AT0038R	Gerlitzen	8307	363	1159	78	68	11	0	0	0	0	162.4	2015-07-08
AT0040R	Masenberg	8370	365	837	67	32	6	0	0	0	0	164.4	2015-07-17
AT0041R	Haunsberg	8050	351	600	60	77	15	2	2	0	0	183.2	2015-08-08
AT0043R	Forsthof	8333	365	710	64	130	25	6	2	0	0	196.1	2015-08-13
AT0045R	Dunkelsteinerwald	8329	365	444	60	135	29	12	4	1	1	208.5	2015-07-22
AT0046R	Gänserndorf	8284	365	478	66	107	24	0	0	0	0	179.6	2015-08-13
AT0047R	Stixneusiedl	8365	365	447	65	90	18	5	2	0	0	199.3	2015-08-13
AT0048R	Zoebelboden	8340	365	196	35	2	1	0	0	0	0	151.4	2015-07-16
AT0049R	Grebenzen bei St. Lamprecht	8349	365	869	78	26	8	0	0	0	0	157.2	2015-08-15
AT0050R	Graz Lustbuehel	8370	365	373	51	10	4	0	0	0	0	160.2	2015-08-14
BG0053R	Rojen Peak	6978	311	335	44	2	1	0	0	0	0	153.3	2015-07-08
CH0001G	Jungfraujoch	8478	365	19	8	0	0	0	0	0	0	138.4	2015-02-22
CH0002R	Payerne	8669	365	389	61	53	15	0	0	0	0	175.3	2015-07-02
CH0003R	Tänikon	8701	365	407	61	94	21	1	1	0	0	180.8	2015-08-13
CH0004R	Chaumont	8664	364	761	62	116	20	2	1	0	0	187	2015-08-12
CH0005R	Rigi	8698	365	783	72	129	19	10	3	2	1	214.8	2015-07-01
CY0002R	Ayia Marina	8463	365	591	77	1	1	0	0	0	0	151.4	2015-08-22
CZ0001R	Svratouch	8151	356	532	46	129	15	1	1	0	0	181.5	2015-08-12
CZ0003R	Kosetice	8427	359	409	44	63	12	0	0	0	0	172	2015-08-13
CZ0003R	Kosetice	7865	332	417	40	95	15	0	0	0	0	177.4	2015-08-13
CZ0005R	Churanov	8561	365	627	50	125	13	0	0	0	0	179.9	2015-08-13
DE0001R	Westerland	8355	365	77	12	5	3	0	0	0	0	162	2015-07-04
DE0002R	Waldhof	8362	365	136	20	37	9	3	1	0	0	196.5	2015-07-04
DE0003R	Schauinsland	6482	283	826	69	262	26	69	7	28	5	245	2015-07-02
DE0007R	Neuglobsow	8148	365	134	22	18	7	0	0	0	0	176.7	2015-08-07
DE0008R	Schmücke	8292	365	602	51	160	19	21	4	6	2	216.7	2015-08-07
DE0009R	Zingst	8212	361	61	11	6	3	0	0	0	0	162.2	2015-07-04

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)
DK0005R	Keldsnor	7704	359	31	6	1	1	0	0	0	0	155.4	2015-08-04
DK0010G	Villum Research Station, Station Nord	5637	269	0	0	0	0	0	0	0	0	94.1	2015-04-18
DK0012R	Risoe	7256	334	34	5	3	1	0	0	0	0	166.8	2015-07-05
DK0031R	Ulborg	7737	357	47	9	0	0	0	0	0	0	144.5	2015-08-21
EE0009R	Lahemaa	8744	365	1	1	0	0	0	0	0	0	121	2015-07-04
EE0011R	Vilsandi	8552	363	31	7	0	0	0	0	0	0	145	2015-08-27
ES0001R	San Pablo de los Montes	8671	365	1304	102	132	18	0	0	0	0	174.6	2015-07-15
ES0005R	Noya	8317	360	53	14	5	1	0	0	0	0	160.3	2015-06-29
ES0006R	Mahón	8544	364	141	28	0	0	0	0	0	0	143.3	2015-05-04
ES0007R	Víznar	8317	358	766	112	20	8	1	1	0	0	188.9	2015-05-12
ES0008R	Niembro	8569	365	25	9	0	0	0	0	0	0	140	2015-08-02
ES0009R	Campisabalos	8591	364	76	24	3	3	0	0	0	0	152.2	2015-06-29
ES0010R	Cabo de Creus	8259	354	26	7	1	1	0	0	0	0	155.7	2015-06-26
ES0011R	Barcarrota	8325	359	54	11	0	0	0	0	0	0	143.1	2015-07-14
ES0012R	Zarra	8638	365	654	89	34	11	0	0	0	0	165.3	2015-06-29
ES0013R	Penausende	8543	365	123	28	0	0	0	0	0	0	144	2015-07-14
ES0014R	Els Torms	8601	365	325	64	5	3	0	0	0	0	165.9	2015-06-09
ES0016R	O Saviñao	8451	360	47	13	5	1	0	0	0	0	179.2	2015-08-10
ES0017R	Doñana	8659	365	168	38	0	0	0	0	0	0	145.9	2015-07-06
FI0009R	Utö	8700	365	6	2	0	0	0	0	0	0	133.5	2015-08-27
FI0018R	Virolahti III	8647	363	0	0	0	0	0	0	0	0	104	2015-05-10
FI0022R	Oulanka	8712	365	0	0	0	0	0	0	0	0	107.9	2015-05-08
FI0037R	Ähtäri II	8488	360	2	1	0	0	0	0	0	0	120.6	2015-04-12
FI0096G	Pallas (Sammaltunturi)	8706	365	0	0	0	0	0	0	0	0	111.4	2015-05-31
FR0008R	Donon	8733	365	235	27	28	6	0	0	0	0	174	2015-07-01
FR0009R	Revin	8546	360	192	23	21	4	1	1	1	1	202	2015-07-02
FR0010R	Morvan	8070	354	369	48	41	7	3	1	0	0	193	2015-07-03
FR0013R	Peyrusse Vieille	8073	341	107	22	11	5	0	0	0	0	156	2015-06-26
FR0014R	Montandon	8619	363	299	43	36	11	0	0	0	0	177	2015-07-03
FR0015R	La Tardière	8290	353	63	15	0	0	0	0	0	0	150	2015-06-26

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)
FR0016R	Le Casset	8526	357	548	65	13	4	0	0	0	0	159	2015-07-16
FR0017R	Montfranc	8657	364	239	31	2	1	0	0	0	0	159	2015-07-16
FR0018R	La Coulonche	8590	361	89	14	4	2	0	0	0	0	163	2015-07-01
FR0019R	Pic du Midi	8705	365	316	41	22	8	1	1	0	0	186	2015-07-14
FR0023R	Saint-Nazaire-le-Désert	8318	359	370	61	54	19	2	2	0	0	191	2015-06-30
FR0025R	Verneuil	8681	364	170	33	14	4	0	0	0	0	164	2015-07-16
FR0030R	Puy de Dôme	8218	361	693	67	40	10	0	0	0	0	167	2015-07-06
GB0002R	Eskdalemuir	8684	365	24	4	0	0	0	0	0	0	148	2015-07-01
GB0006R	Lough Navar	8660	365	16	4	0	0	0	0	0	0	130.3	2015-04-10
GB0013R	Yarner Wood	8600	364	27	7	0	0	0	0	0	0	141.3	2015-04-09
GB0014R	High Muffles	8094	344	45	7	14	2	4	1	0	0	196.9	2015-07-01
GB0015R	Strath Vaich Dam	8643	365	23	4	0	0	0	0	0	0	140.6	2015-08-23
GB0031R	Aston Hill	8605	363	12	3	0	0	0	0	0	0	147.7	2015-06-13
GB0033R	Bush	8699	365	20	3	0	0	0	0	0	0	141.6	2015-07-01
GB0035R	Great Dun Fell	6942	292	0	0	0	0	0	0	0	0	109.2	2015-04-10
GB0036R	Harwell	8593	363	22	3	6	1	0	0	0	0	162.3	2015-07-01
GB0038R	Lullington Heath	8637	364	26	5	9	2	0	0	0	0	178.6	2015-07-01
GB0039R	Sibton	8740	365	34	7	13	2	7	1	6	1	220.6	2015-07-01
GB0043R	Narberth	8666	365	8	3	0	0	0	0	0	0	126.8	2015-04-09
GB0045R	Wicken Fen	8674	365	64	10	19	3	5	1	2	1	207	2015-07-01
GB0048R	Auchencorth Moss	8674	365	16	2	0	0	0	0	0	0	137.9	2015-07-01
GB0049R	Weybourne	8749	365	44	8	15	3	9	1	7	1	224.5	2015-07-01
GB0050R	St. Osyth	8203	348	21	3	5	1	0	0	0	0	177.8	2015-07-01
GB0052R	Lerwick	8037	338	5	3	0	0	0	0	0	0	126.8	2015-08-03
GB0053R	Charlton Mackrell	8742	365	24	5	0	0	0	0	0	0	143	2015-06-11
GR0001R	Aliartos	8262	349	176	40	0	0	0	0	0	0	150	2015-08-30
GR0002R	Finokalia	8092	345	663	76	9	2	0	0	0	0	155	2015-08-30
HU0002R	K-puszta	6947	291	139	35	1	1	0	0	0	0	151.3	2015-08-16
IE0001R	Valentia Observatory	8754	365	2	1	0	0	0	0	0	0	125.6	2015-04-08
IE0031R	Mace Head	8759	365	2	1	0	0	0	0	0	0	126.3	2015-04-10

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)
IT0001R	Montelibretti	7392	314	261	56	49	16	7	7	2	2	203.7	2015-07-15
IT0004R	Ispra	7976	341	544	86	226	42	78	21	27	9	255.4	2015-07-15
LT0015R	Preila	8496	360	64	12	0	0	0	0	0	0	149.4	2015-07-05
LV0010R	Rucava	7525	319	52	12	7	1	0	0	0	0	159.3	2015-07-05
LV0016R	Zoseni	8549	361	0	0	0	0	0	0	0	0	116.5	2015-04-26
MK0007R	Lazaropole	7004	310	1274	137	159	28	0	0	0	0	179.3	2015-05-14
MT0001R	Giordan lighthouse	8113	345	278	50	0	0	0	0	0	0	144.9	2015-05-03
NL0007R	Eibergen	8509	361	99	18	26	6	12	2	2	1	223.5	2015-07-02
NL0009R	Kollumerwaard	8573	365	62	12	14	3	3	1	0	0	198.3	2015-07-02
NL0010R	Vredepeel	8482	362	166	30	49	11	14	3	8	2	226.9	2015-07-02
NL0091R	De Zilk	8569	364	84	17	17	4	6	1	4	1	222.4	2015-07-01
NL0644R	Cabauw Wielsekade	8525	364	101	20	19	5	9	2	4	1	213	2015-07-01
NO0002R	Birkenes II	8696	365	5	2	0	0	0	0	0	0	142.2	2015-07-05
NO0015R	Tustervatn	8025	341	3	1	0	0	0	0	0	0	136.5	2015-07-03
NO0039R	Kårvatn	8589	361	0	0	0	0	0	0	0	0	114.2	2015-04-11
NO0042G	Zeppelin mountain (Ny-Ålesund)	8712	365	0	0	0	0	0	0	0	0	113.3	2015-07-10
NO0043R	Prestebakke	8729	365	4	2	0	0	0	0	0	0	131.2	2015-04-11
NO0052R	Sandve	8179	346	7	4	0	0	0	0	0	0	137.4	2015-07-03
NO0056R	Hurdal	8311	349	3	1	0	0	0	0	0	0	122	2015-08-22
PL0002R	Jarczew	8747	365	134	24	12	4	0	0	0	0	163	2015-09-01
PL0003R	Sniezka	8725	365	641	54	135	20	4	1	0	0	186	2015-08-12
PL0004R	Leba	8727	365	97	13	9	6	0	0	0	0	161	2015-06-06
PL0005R	Diabla Gora	8731	365	116	23	10	1	0	0	0	0	155.8	2015-07-05
RS0005R	Kamenicki vis	6399	277	919	87	27	9	0	0	0	0	174	2015-08-27
SE0005R	Bredkälen	8734	365	0	0	0	0	0	0	0	0	102	2015-07-03
SE0011R	Vavihill	8694	365	31	5	1	1	0	0	0	0	152	2015-07-05
SE0012R	Aspvreten	8255	355	0	0	0	0	0	0	0	0	116	2015-06-06
SE0013R	Esrange	8744	365	1	1	0	0	0	0	0	0	132	2015-05-09

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)
SE0014R	Råö	8672	363	17	4	0	0	0	0	0	0	132	2015-08-04
SE0018R	Asa	8616	361	15	5	0	0	0	0	0	0	132	2015-06-13
SE0019R	Östad	8739	365	17	5	0	0	0	0	0	0	136	2015-07-03
SE0032R	Norra-Kvill	8739	365	15	4	0	0	0	0	0	0	138	2015-06-06
SE0035R	Vindeln	8736	365	0	0	0	0	0	0	0	0	99	2015-04-09
SE0039R	Grimsö	8737	365	1	1	0	0	0	0	0	0	122	2015-05-24
SI0008R	Iskrba	8350	365	296	53	1	1	0	0	0	0	151.2	2015-07-07
SI0031R	Zarodnje	8307	365	1074	101	138	24	0	0	0	0	177.7	2015-08-14
SI0032R	Krvavec	8217	362	1447	108	92	25	1	1	0	0	185.8	2015-07-07
SI0033R	Kovk	6923	303	1527	115	242	44	5	2	1	1	201.3	2015-05-13
SK0002R	Chopok	5448	231	250	29	4	2	0	0	0	0	161	2015-06-05
SK0004R	Stará Lesná	5451	229	97	22	0	0	0	0	0	0	147	2015-08-13
SK0006R	Starina	4800	202	42	10	2	1	0	0	0	0	154	2015-07-08
SK0007R	Topolniky	5440	228	69	17	3	3	0	0	0	0	155	2015-07-06

Table 1.2: Percentiles of hourly ozone values April–September 2015.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
AT0002R	Illmitz	60.1	76.4	98.2	122.3	135.3	150.6	162.1	92.6
AT0005R	Vorhegg	59.1	77.8	94.2	109.3	119.2	128.6	134	95
AT0030R	Pillersdorf bei Retz	60.9	77	96.4	116.5	133.5	148.2	156.9	94.6
AT0032R	Sulzberg	78.4	95.4	115.7	136.4	146.9	159.7	165.6	95.5
AT0034G	Sonnblick	98.4	111.3	123.1	135.9	142.2	152.1	157.2	95.2
AT0038R	Gerlitzen	92.2	105.2	122.1	134.3	141.5	148	152.6	95.7
AT0040R	Masenberg	79.2	94.8	114.9	129.3	137.1	143.9	148.2	95.5
AT0041R	Haunsberg	67.4	84.2	105.3	126.9	138.7	149	156.5	96.2
AT0043R	Forsthof	67.8	84.4	109.2	131.9	142	155.8	165	94.9
AT0045R	Dunkelsteinerwald	52.3	71.6	93.6	121.6	142.7	157.2	165.5	94.8
AT0046R	Gänserndorf	54.5	72.4	96	124.4	139.3	153.2	162.2	95.5
AT0047R	Stixneusiedl	57.9	74.5	97.6	120.9	133.9	151	155.8	95.6
AT0048R	Zoebelboden	59.1	77.8	94.2	109.3	119.2	128.6	134	95
AT0049R	Grebenzen bei St. Lamprecht	86.4	99.8	116.7	127.9	134.7	142.4	147.7	95.1
AT0050R	Graz Lustbuehel	58.9	79.4	101.6	118.7	125.9	136.1	140.7	95.7
BG0053R	Rojen Peak	87	97.6	109.9	119.1	123.7	128.7	132.2	84.4
CH0001G	Jungfraujoch	72.7	81.3	90.6	99	103.3	107.7	112.8	96.9
CH0002R	Payerne	50.5	71.9	93.5	116.9	130.2	144.2	152	99.1
CH0003R	Tänikon	50.6	70.5	93.4	118.2	134.1	151.8	161	99.3
CH0004R	Chaumont	79.6	94.1	112	130.6	142.3	153.6	157.5	99.4
CH0005R	Rigi	77.2	91.8	112.2	131.1	142.1	157.4	166.3	99.1
CY0002R	Ayia Marina	91.7	103.7	113.9	122.5	126.5	130.7	133.9	97.2
CZ0001R	Svratouch	66.2	81.8	102.1	127.1	142.9	157.4	164.3	93.9
CZ0003R	Kosetice	57.1	75	95.8	118.9	133.2	146.8	153.4	98.2
CZ0003R	Kosetice	61.8	79	99.7	122.2	137.6	152.9	159	86.5
CZ0005R	Churanov	70.8	85.8	106.3	129.5	142	153.6	160.8	96.9
DE0001R	Westerland	67.7	77.2	86.4	94.3	100	118	130	95.1
DE0002R	Waldhof	44.6	63.6	81.6	99.4	112.8	133.3	147.4	95.8
DE0003R	Schauinsland	77.6	93.9	114	138	155	177	191	95.2
DE0007R	Neuglobsow	42.4	64.5	82.2	96.9	111.2	132.9	142.8	91.6
DE0008R	Schmücke	67.9	84.8	105.2	129.8	145.1	158.3	165.8	95.3
DE0009R	Zingst	60.5	71.4	81.7	91.1	97.9	112.7	127.1	95.3
DK0005R	Keldsnor	56.9	66.7	76.2	85.4	92.5	103.1	117	85.5
DK0010G	Villum Research Station, Station Nord	39.6	52.2	63.2	73.7	81.7	87.8	89.7	66.6
DK0012R	Risoe	60.5	71.7	81.4	91.7	99	112.1	121.8	75.4
DK0031R	Ulborg	63.3	72.5	82.1	91.3	99.6	114.7	125.2	89.7
EE0009R	Lahemaa	44	62	76	86	91	97	103	99.8
EE0011R	Vilsandi	65	75	85	93	98	107	114	97.9
ES0001R	San Pablo de los Montes	93.8	107.7	123.6	136.1	144.4	154.2	158.9	99
ES0005R	Noya	57.9	72	86.5	97.9	105.4	114.4	121	96.9
ES0006R	Mahón	70.5	85.6	100.1	110	115.5	123.5	129.5	98.2
ES0007R	Víznar	86.6	101.2	115.3	128	133.8	140.2	145.1	92.5
ES0008R	Niembro	65.7	76.4	87.7	97.3	102.5	108.5	114	97.9
ES0009R	Campisabalos	60.3	76.3	88.6	102.1	109.8	118.8	126.8	97.8
ES0010R	Cabo de Creus	70.7	79.4	90	99.9	105.9	111.5	115.7	93.6
ES0011R	Barcarrota	41.4	62.7	83.6	101.3	109.2	116.3	121.8	94.6
ES0012R	Zarra	84.9	98.9	112.8	125	131.7	141.9	147.6	98.5
ES0013R	Penausende	64.2	79.9	95.9	108.5	115.5	122.7	126.8	97.2
ES0014R	Els Torms	76.8	92.2	107	117.4	122.9	131.3	136.6	97.7
ES0016R	O Saviñao	47	61.5	77.5	92.9	102.3	112.5	120.6	97.7
ES0017R	Doñana	56.6	78.5	95.7	110.3	117.3	124.7	130.6	98.5
FI0009R	Utö	63	71.5	80.7	88.2	92.2	97.2	101.5	99.8
FI0018R	Virolahti III	40	58.3	71.6	79.8	84.6	90.2	93	99.4
FI0022R	Oulanka	42	55.6	68.6	78.6	82.9	87.8	91.4	99.3
FI0037R	Ähtäri II	39.5	54.8	69.1	80	86.1	91.3	94.4	96.9
FI0096G	Pallas (Sammaltunturi)	53.6	64	76.1	85.8	89.8	93.2	96.4	99.8
FR0008R	Donon	54	70	89	109.5	122	135	142.1	99.8
FR0009R	Revin	54	69	86	104	119	133	143	95.7
FR0010R	Morvan	63	80	98	118	128	143	150.5	94.5

Table 1.2, cont.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
FR0013R	Peyrusse Vieille	61	75	89	103	114	124	132	90.5
FR0014R	Montandon	55	72	93	114	126.1	141	148	97.4
FR0015R	La Tardière	52	67	82	96	105	118	124	97.9
FR0016R	Le Casset	87	100	112	123	131	138	142	94.8
FR0017R	Montfranc	72	85	100	113	121.8	129	132	98
FR0018R	La Coulonche	60	72	85	98	108	122	132	96.7
FR0019R	Pic du Midi	76	85	99	115	126	139	143	99.7
FR0023R	Saint-Nazaire-le-Désert	57	83	101	119	130	144	154.2	95.1
FR0025R	Verneuil	46	67	87	105	117	128.3	137.2	99.8
FR0030R	Puy de Dôme	84	99	113	128	135	144	150.1	93.1
GB0002R	Eskdalemuir	44.9	57.8	69.9	79.4	86.1	98.8	109	98.4
GB0006R	Lough Navar	36.7	53.6	68	81.2	88.3	95.9	106.7	99.3
GB0013R	Yarner Wood	51.8	64.7	79.9	94	100.1	109.1	115.4	98.7
GB0014R	High Muffles	52.1	63.8	74.7	86.8	93.1	105.7	121.7	96.5
GB0015R	Strath Vaich Dam	57.3	67.4	80.2	89.6	94.4	102.2	113.1	99.4
GB0031R	Aston Hill	55.9	64.9	74.5	83.5	89.1	99.2	107.8	97.9
GB0033R	Bush	48.6	60.2	71.9	81.6	87.2	96.5	110	99.3
GB0035R	Great Dun Fell	38.5	54.1	67.6	78.3	84.1	91.4	95.2	59.2
GB0036R	Harwell	45.6	58.9	73	83.6	90.6	100.5	107.9	97.5
GB0038R	Lullington Heath	46.9	60.2	72.7	82.3	89.6	101.6	111	98.1
GB0039R	Sibton	44.4	59.3	72.7	84	91.9	104.4	117	99.9
GB0043R	Narberth	50.2	59.5	70.9	80.3	86.1	95.6	105.4	99.7
GB0045R	Wicken Fen	39.8	58.9	77	89.5	97.1	112.3	128.8	99
GB0048R	Auchencorth Moss	49	60	70	79.3	84.6	96	106.7	99.3
GB0049R	Weybourne	56.8	69.4	80.7	90.2	96.7	108.5	120.5	99.9
GB0050R	St. Osyth	43.1	57	70.3	81.4	88	94.7	103.7	92.2
GB0052R	Lerwick	59.7	69.1	78.6	86	90.7	98.4	105.4	95.2
GB0053R	Charlton Mackrell	48	63.2	77.6	90.5	95.7	103.4	112.7	99.8
GR0001R	Aliartos	45	76	101	113	119	128	132	90.9
GR0002R	Finokalia	96.6	106.2	115.4	124.7	130	135.9	141	92.1
HU0002R	K-puszta	35.2	62.1	89.8	108.9	117	124.5	129.9	92.1
IE0001R	Valentia Observatory	57.1	67.1	78.8	89.2	94.1	100	104.5	100
IE0031R	Mace Head	64.7	72.7	82	90.8	96.2	100.2	105	100
IT0001R	Montelibretti	25.8	52.2	81.5	110.2	127.3	141.7	153.7	86.3
IT0004R	Ispra	47.2	71.3	97.9	130	154.9	179.6	193.3	90.5
LT0015R	Preila	58.3	71.5	81.7	92.2	101	114.7	127.8	99.3
LV0010R	Rucava	51.4	73	85	94.5	103	113.6	123.7	98.5
LV0016R	Zoseni	41	58.7	72.7	83.8	89.4	95.6	99.7	99.9
MK0007R	Lazaropole	74.4	95.2	116.5	133.3	144.4	155.1	159.7	90.3
MT0001R	Giordan lighthouse	88.8	98.8	108	116.6	122.7	129.9	133.2	93
NL0007R	Eibergen	33.2	50.5	70.5	88.3	104.1	124.7	142.4	95.6
NL0009R	Kollumerwaard	45.8	60.9	73.4	83.9	93.9	114	126.4	97.9
NL0010R	Vredepeel	36.4	54.9	74.7	95.9	114.4	136.6	154.9	97.1
NL0091R	De Zilk	49.4	65.6	78	89.8	101	119.6	132.5	97.2
NL0644R	Cabauw Wielsekade	36.8	54.3	71.6	87.9	99.8	123.6	138	98
NO0002R	Birkenes II	58.5	69.2	79.7	88.8	92.7	98	103.6	99.2
NO0015R	Tustervatn	55.2	66.7	77.7	85.7	88.6	91.2	93.7	98.3
NO0039R	Kårvatn	32.4	53.5	70.7	82.3	87.7	93.9	97.9	99.1
NO0042G	Zeppelin mountain (Ny-Ålesund)	54.1	61.5	70.4	81.9	87.8	93.6	95	99.4
NO0043R	Prestebakke	53.9	66.2	77.6	85.8	90.7	97.7	102.7	99.6
NO0052R	Sandve	61.1	70.2	79	86.1	91.2	101.3	109.2	92.3
NO0056R	Hurdal	49.6	63	75.2	85	90.5	98.4	103.6	99.3
PL0002R	Jarczew	44	63	81	100	111	126	138	99.8
PL0003R	Sniezka	79	92	109	132	144	157	163	99.5
PL0004R	Leba	61	74	84	95	104	122	136	99.9
PL0005R	Diabla Gora	52	68.1	83.3	98.7	111.3	122.8	132.5	100
RS0005R	Kamenicki vis	84.1	102	118	130	137	143	148	98.2

Table 1.2, cont.

Code	Station	25%	50%	75%	90%	95%	98%	99%	Data capture
SE0005R	Bredkälen	45	59	72	83	88	93	96	99.7
SE0011R	Vavihill	54	66	77	86	93.6	104.3	113	99.9
SE0012R	Aspvreten	43	60	71	80	85	92	97	91.3
SE0013R	Esrange	53	64	77	88	92	95.3	98	99.8
SE0014R	Råö	63	73	82	89	95	104	112	98.3
SE0018R	Asa	48	65	76	86	92	99	108	97.4
SE0019R	Östad	46	65	76	86	91	101	111.2	99.7
SE0032R	Norra-Kvill	59	70	79	89	94	101.4	108	99.7
SE0035R	Vindeln	42	57	72	81	86	91	93	99.7
SE0039R	Grimsö	45	62	75	86	91	96	99	99.7
SI0008R	Iskrba	17.4	62.2	94.8	114.7	124.3	131.8	135.6	94.9
SI0031R	Zarodnje	81.4	100.6	122.1	139.2	145.6	156.3	162.7	94.7
SI0032R	Krvavec	94.2	108.8	126.1	138.5	144.1	151.2	155.5	94.7
SI0033R	Kovk	87.8	107.1	128.5	143.5	152	160.6	166.4	93.9
SK0002R	Chopok	82	94	107	118	125	133	138	74.9
SK0004R	Stará Lesná	55	74	91	107	115	124	130	75
SK0006R	Starina	53	69	85	101	109	117	124	60.4
SK0007R	Topolniky	44	62	81	101	110	121.3	129	74.7

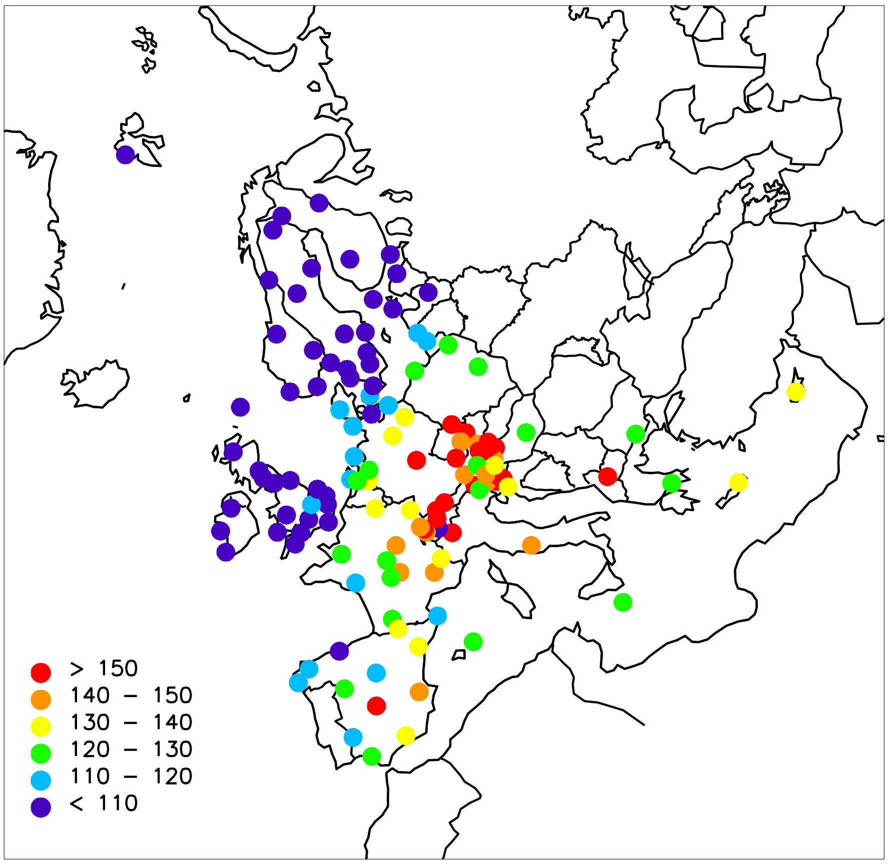


Figure 1.1: Ozone April–September 2015. 99-percentiles (µg/m³).

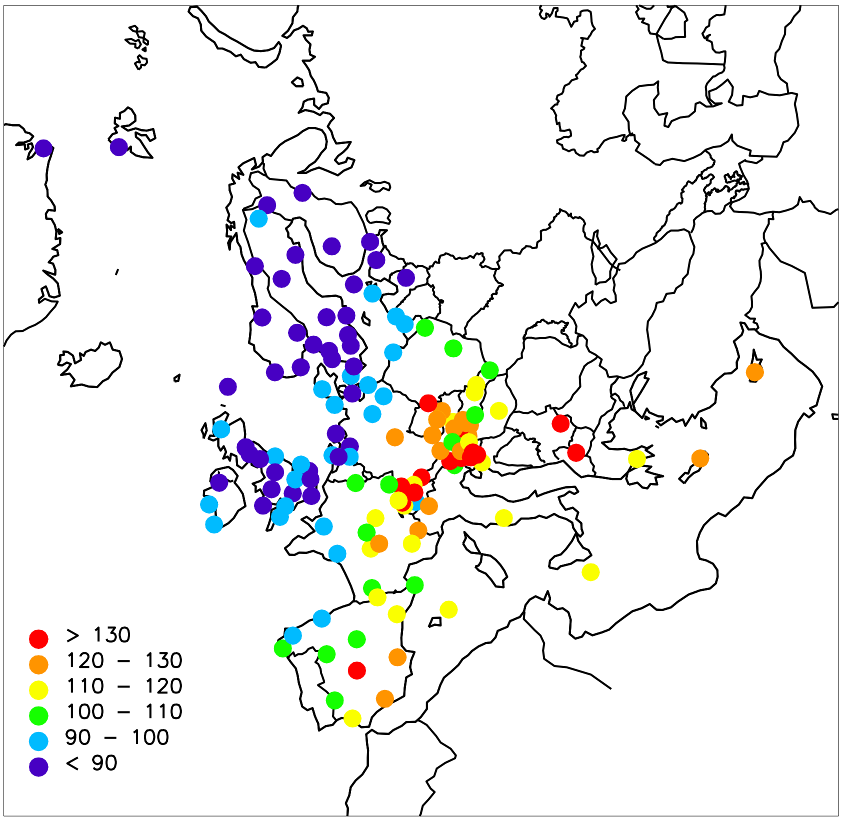


Figure 1.2: Ozone April–September 2015. 95-percentiles ($\mu g/m^3$).

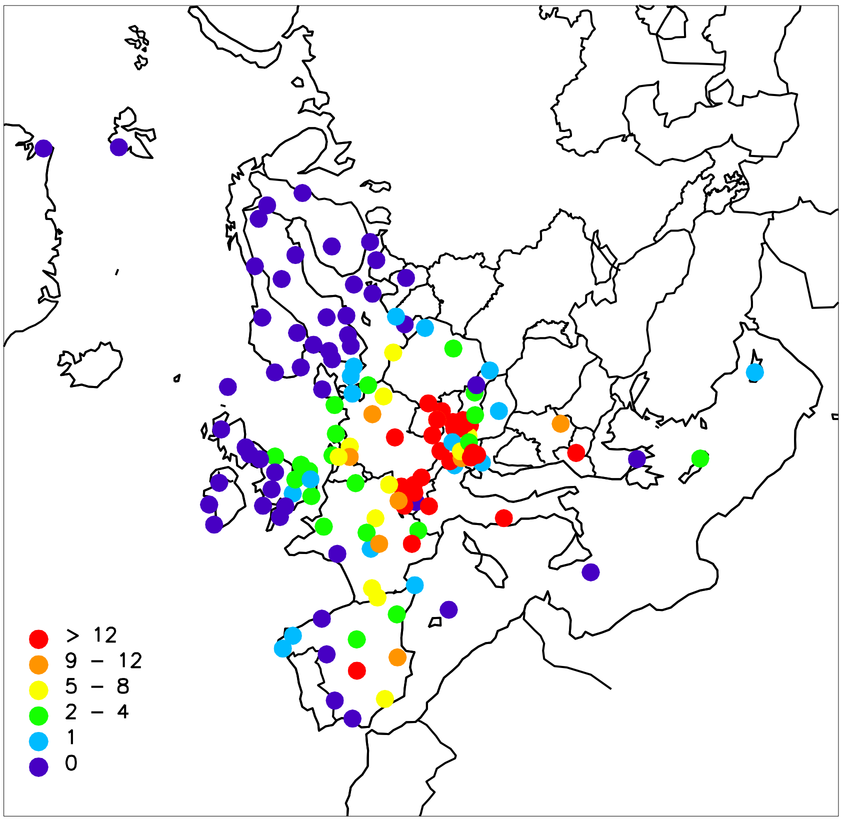


Figure 1.3: Number of exceedances of the threshold value of 150 $\mu g/m^3$. (Unit: number of days).

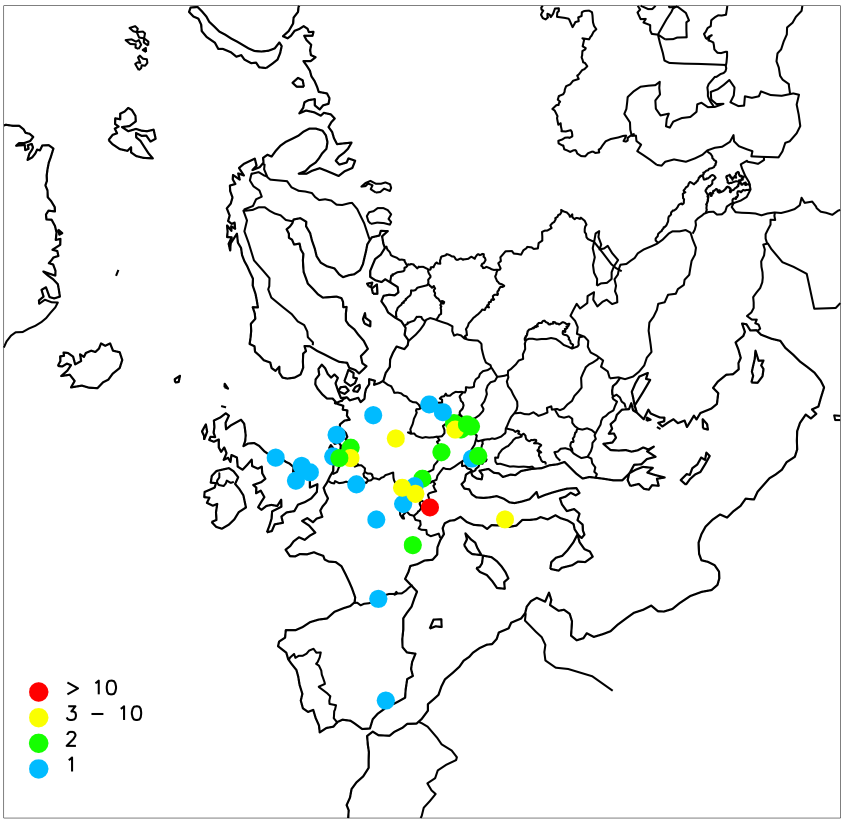


Figure 1.4: Number of exceedances of the threshold value of 180 μg/m^3. (Unit: number of days). Stations with zero exceedances are not shown.

Annex 2

AOT40, figures and tables

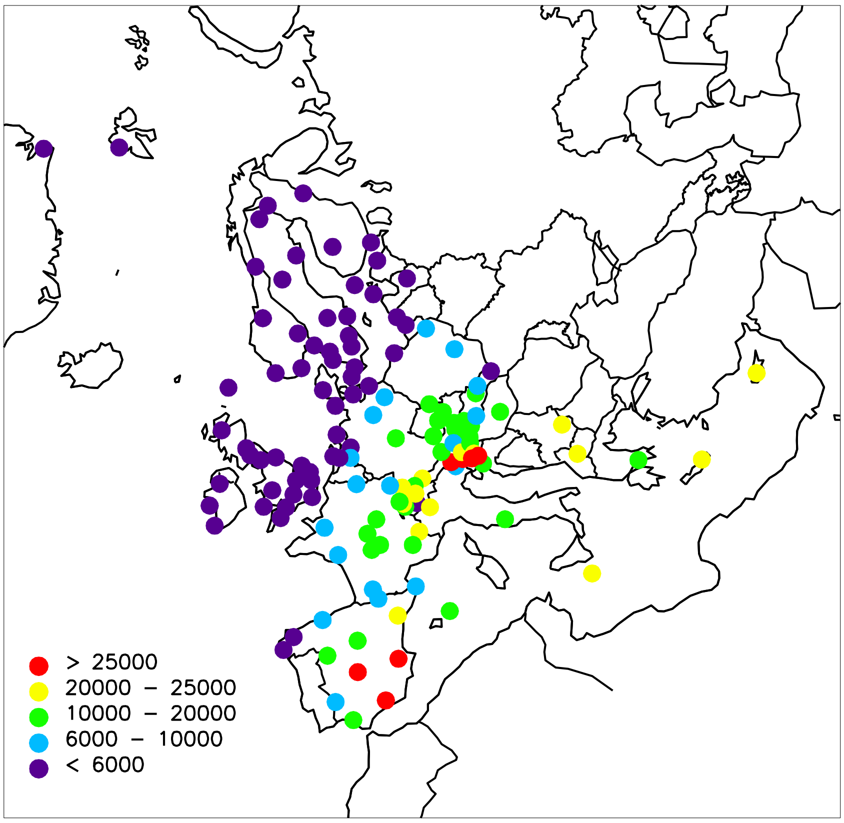


Figure 2.1: AOT40 (ppbh) April–September 2015 (daylight hours).

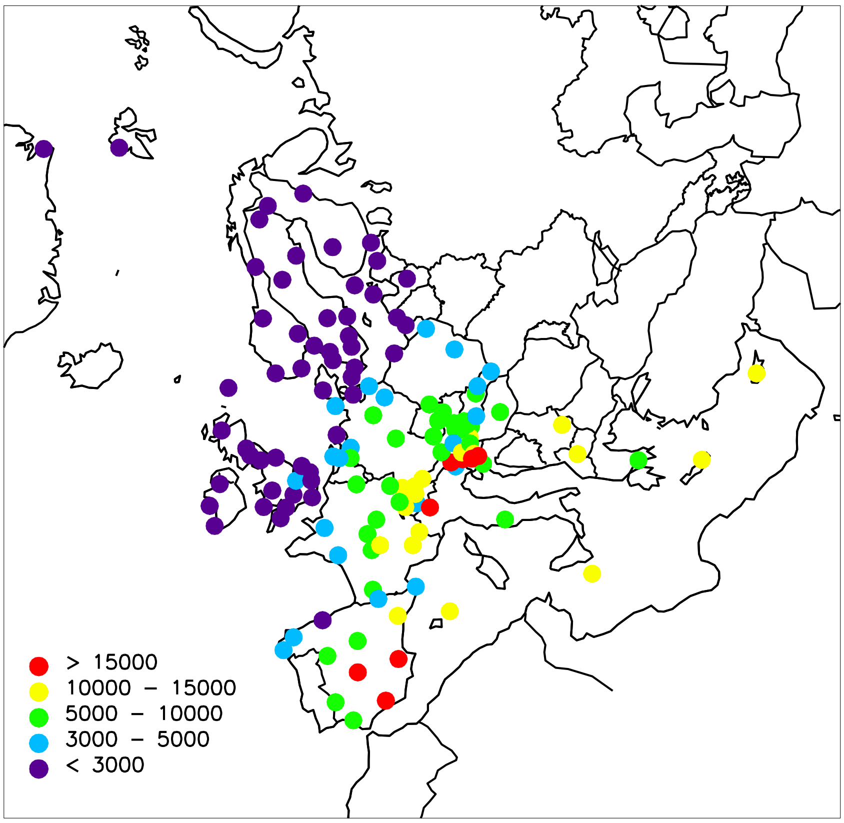


Figure 2.2: AOT40 (ppbh) May, June and July 2015 (daylight hours).

Table 2.1: AOT40 May-July and April–September 2015 (daylight hours).

Code	Station	May - July			April - September		
		AOT40	AOT40 corrected	Data capture	AOT40	AOT40 corrected	Data capture
AT0002R	Illmitz	8864.6	9312.4	95.2	15270.7	16611.2	91.9
AT0005R	Vorhegg	4638.7	4969.4	93.3	8369.9	8880.7	94.2
AT0030R	Pillersdorf bei Retz	7255.9	7669.9	94.6	12699.8	13532.9	93.8
AT0032R	Sulzberg	13237.8	13359.6	99.1	21601.5	21794.5	99.1
AT0034G	Sonnblick	16766	17815.9	94.1	29395	31182.6	94.3
AT0038R	Gerlitzen	15335	16057	95.5	25447.5	26670.4	95.4
AT0040R	Masenberg	11444.2	12011.6	95.3	19729.7	20758	95
AT0041R	Haunsberg	9081.4	9375.7	96.9	14660	15285.7	95.9
AT0043R	Forsthof	9540.9	10133.8	94.1	16547.9	17497.8	94.6
AT0045R	Dunkelsteinerwald	8869.1	9375.7	94.6	14731.1	15536.5	94.8
AT0046R	Gänserndorf	9268.6	9735.1	95.2	15629.5	16393	95.3
AT0047R	Stixneusiedl	7840.1	8204.7	95.6	13991.4	14638.4	95.6
AT0048R	Zoebelboden	4644.2	4971.5	93.4	8365.5	8878.7	94.2
AT0049R	Grebenzen bei St. Lamprecht	11889.2	12552.2	94.7	20481.6	21562.9	95
AT0050R	Graz Lustbuehel	6979.5	7319.6	95.4	11548.9	12071.2	95.7
BG0053R	Rojen peak	8893.5	9205.5	96.6	6518	18551.9	89
CH0001G	Jungfraujoch	3676.3	3825.5	96.1	5781.3	5996.4	96.4
CH0002R	Payerne	11604.2	11796.6	98.4	17879	18219.4	98.1
CH0003R	Tänikon	11574.1	11734	98.6	19076.5	19371.8	98.5
CH0004R	Chaumont	12621.2	12783.3	98.7	20335.8	20609.5	98.7
CH0005R	Rigi	13626.7	13891.4	98.1	21383.9	21801.5	98.1
CY0002R	Ayia Marina	14227.8	14845.8	95.8	24166	25166.5	96
CZ0001R	Svratouch	9213.5	9690.8	95.1	17512.6	18282.1	95.8
CZ0003R	Kosetice	9038.1	9086	99.5	16591.6	16802.8	98.7
CZ0003R	Kosetice	7669.2	10080.8	76.1	16061.3	18795.7	85.5
CZ0005R	Churanov	9976.9	10258.6	97.3	18554.3	18977.5	97.8
DE0001R	Westerland	3173.3	3358.8	94.5	5631	5941.8	94.8
DE0002R	Waldhof	5871.1	6137.5	95.7	9269.8	9703.2	95.5
DE0003R	Schauinsland	13902.4	14800.7	93.9	22568.1	23784.3	94.9
DE0007R	Neuglobsow	4405.4	4704.9	93.6	8138.2	9212	88.3
DE0008R	Schmücke	9846.2	10395.9	94.7	17539.9	18505.2	94.8
DE0009R	Zingst	3059.8	3248.9	94.2	5044.6	5337.6	94.5
DK0005R	Keldsnor	1135.8	1327.8	85.5	2166.3	2370.2	91.4
DK0010G	Villum Research Station, Station Nord	3.8	4.1	92.4	70.5	81.3	86.8
DK0012R	Risoe	2228.9	2524.5	88.3	3846	4776.4	80.5
DK0031R	Ulborg	2141.1	2223.9	96.3	4504.8	4690.3	96
EE0009R	Lahemaa	1156	1160	99.7	1965	1974.5	99.5
EE0011R	Vilsandi	2216.5	2295.1	96.6	3595.5	3673.1	97.9
ES0001R	San Pablo de los Montes	20718.7	21009.4	98.6	32016	32565	98.3
ES0005R	Noya	3349.7	3515.5	95.3	5302.9	5517.3	96.1
ES0006R	Mahón	10689.7	10891.2	98.1	13478.7	13785.2	97.8
ES0007R	Víznar	17387.5	18455.9	94.2	25386.2	27542.9	92.2
ES0008R	Niembro	2925.1	3074.4	95.1	6125.1	6337.7	96.6
ES0009R	Campisabalos	6895.5	7126.2	96.8	10486.3	10802.3	97.1
ES0010R	Cabo de Creus	4424.2	4612.3	95.9	6597.5	7122	92.6
ES0011R	Barcarrota	6737.8	7033	95.8	8559.4	9061.3	94.5
ES0012R	Zarra	18140.9	18567.8	97.7	25541.6	26186.4	97.5
ES0013R	Penausende	7745	7993.4	96.9	11983.9	12444.6	96.3
ES0014R	Els Torms	13089.5	13519.3	96.8	20508.4	21125.4	97.1
ES0016R	O Saviñao	3606.6	3721.2	96.9	5718.1	5877	97.3
ES0017R	Doñana	9085.1	9289.4	97.8	14427.9	14749.6	97.8
FI0009R	Utö	972.7	974.3	99.8	2149	2156.2	99.7
FI0018R	Virolahti III	642.1	642.1	100	1011	1020.8	99
FI0022R	Oulanka	170.4	171.4	99.4	619.2	624.3	99.2
FI0037R	Ähtäri II	457.7	480.7	95.2	990.7	1026.9	96.5
FI0096G	Pallas (Sammaltunturi)	465.2	467.1	99.6	1241.4	1244.4	99.8

Table 2.1, cont.

Code	Station	May - July			April - September		
		AOT40	AOT40 corrected	Data capture	AOT40	AOT40 corrected	Data capture
FR0008R	Donon	5297	5311.4	99.7	9495	9532.5	99.6
FR0009R	Revin	5357.5	5860.4	91.4	9030	9502.3	95
FR0010R	Morvan	9108	9461.6	96.3	16425	17081.7	96.2
FR0013R	Peyrusse Vieille	6206.5	6252.6	99.3	8835	9758.9	90.5
FR0014R	Montandon	8461.5	8515.5	99.4	13655	14020.5	97.4
FR0015R	La Tardière	4107.5	4240.6	96.9	7061.5	7219.8	97.8
FR0016R	Le Casset	13856	15071	91.9	22981.5	24308	94.5
FR0017R	Montfranc	8372.5	8456.8	99	13658.5	13910.6	98.2
FR0018R	La Coulonche	3907.5	4153.6	94.1	7198.5	7462.2	96.5
FR0019R	Pic du Midi	4419	4452.1	99.3	9589	9641.5	99.5
FR0023R	Saint-Nazaire-le-Désert	11378	12293.6	92.6	19112.5	19988.4	95.6
FR0025R	Verneuil	7092	7117.7	99.6	12110	12163.6	99.6
FR0030R	Puy de Dôme	10829.5	12827.5	84.4	19295.5	21460.7	89.9
GB0002R	Eskdalemuir	853.1	870.5	98	1731.6	1768.3	97.9
GB0006R	Lough Navar	572.3	574.3	99.6	2054.2	2069.5	99.3
GB0013R	Yarner Wood	2737.2	2792.3	98	5063.7	5167	98
GB0014R	High Muffles	1750.1	1849.3	94.6	2901.7	3026.9	95.9
GB0015R	Strath Vaich Dam	1361.1	1369.4	99.4	3266.6	3300.1	99
GB0031R	Aston Hill	998	1015.9	98.2	1674	1707.8	98
GB0033R	Bush	716.8	718.7	99.7	1790.6	1808	99
GB0035R	Great Dun Fell	0	0	17.9	401.5	740.5	54.2
GB0036R	Harwell	1676.9	1766.6	94.9	2671.7	2765.1	96.6
GB0038R	Lullington Heath	1670.9	1734.5	96.3	2082	2127.2	97.9
GB0039R	Sibton	2028.1	2031.6	99.8	3242.2	3251.6	99.7
GB0043R	Narberth	605.6	610	99.3	1173.1	1180	99.4
GB0045R	Wicken Fen	3044.5	3103.9	98.1	5127.1	5187.1	98.8
GB0048R	Auchencorth Moss	618.4	620	99.7	1509.3	1523.2	99.1
GB0049R	Weybourne	2682.1	2689.1	99.7	4409.8	4420.5	99.8
GB0050R	St. Osyth	1191.5	1203	99	1914.2	2078.6	92.1
GB0052R	Lerwick	838	889.5	94.2	1861.4	1961.8	94.9
GB0053R	Charlton Mackrell	2551.2	2564.8	99.5	4163.4	4179.6	99.6
GR0001R	Aliartos	9339	11462	81.5	19330.5	21630.5	89.4
GR0002R	Finokalia	13704.5	13924.9	98.4	22623.5	24454.9	92.5
HU0002R	K-puszta	6164.3	6169.9	99.9	10460.4	11164.7	93.7
IE0001R	Valentia Observatory	971.1	972.8	99.8	2351.8	2354.1	99.9
IE0031R	Mace Head	1435.4	1435.4	100	3100.9	3100.9	100
IT0001R	Montelibretti	9124.9	9867.8	92.5	12240.9	14168.5	86.4
IT0004R	Ispra	16235.7	18956	85.6	23502.7	25994.9	90.4
LT0015R	Preila	1967.8	1992.3	98.8	4106.2	4134.4	99.3
LV0010R	Rucava	2715.4	2715.4	100	4365.7	4430.2	98.5
LV0016R	Zoseni	531.5	531.5	100	864	865.2	99.9
MK0007R	Lazaropole	12653.4	14018.2	90.3	21980.5	24729.5	88.9
MT0001R	Giordan lighthouse	11736.2	12449.7	94.3	20113	21598.4	93.1
NL0007R	Eibergen	3530.7	3791.7	93.1	5204.7	5424	96
NL0009R	Kollumerwaard	2151.8	2203.1	97.7	3606.4	3660.2	98.5
NL0010R	Vredepeel	5245.4	5447.7	96.3	7871.9	8070.8	97.5
NL0091R	De Zilk	3180.8	3284.8	96.8	4900	5009.6	97.8
NL0644R	Cabauw Wielsekade	3421.1	3442.5	99.4	5057.7	5100	99.2
NO0002R	Birkenes II	1389	1407	98.7	2674.6	2707	98.8
NO0015R	Tustervatn	560.4	577.1	97.1	1452.4	1490.3	97.5
NO0039R	Kårvatn	641.9	647.3	99.2	1382.8	1402.8	98.6
NO0042G	Zeppelin mountain (Ny-Ålesund)	215.2	216.7	99.3	653.3	658.3	99.2
NO0043R	Prestebakke	1144.5	1156.4	99	2330.3	2348.5	99.2
NO0052R	Sandve	947.3	1037.4	91.3	1858.2	2033	91.4
NO0056R	Hurdal	710.4	716.6	99.1	1742.8	1763.2	98.8
PL0002R	Jarczew	3174.5	3180.3	99.8	7040.5	7050.9	99.9
PL0003R	Sniezka	9325	9349.5	99.7	17989.5	18112	99.3
PL0004R	Leba	2914.5	2914.5	100	5362.5	5362.5	100
PL0005R	Diabla Gora	4339.6	4339.6	100	7712.5	7712.5	100

Table 2.1, cont.

Code	Station	May - July			April - September		
		AOT40	AOT40 corrected	Data capture	AOT40	AOT40 corrected	Data capture
RS0005R	Kamenicki vis	12950.4	13033	99.4	23855.8	24322.2	98.1
SE0005R	Bredkälen	142	142.5	99.7	1223.5	1226.5	99.8
SE0011R	Vavihill	2015	2016.7	99.9	3335.5	3337.1	100
SE0012R	Aspvreten	417	488.7	85.3	1174	1293	90.8
SE0013R	Esrange	705.5	706.6	99.8	1763	1766.4	99.8
SE0014R	Råö	1890	1945.4	97.2	3548.5	3609.5	98.3
SE0018R	Asa	1532.5	1611.1	95.1	2951	3041.7	97
SE0019R	Östad	1606.5	1613.4	99.6	3231.5	3242.4	99.7
SE0032R	Norra-Kvill	1642	1646.2	99.7	3193	3202.2	99.7
SE0035R	Vindeln	245	245.6	99.8	946.5	948.3	99.8
SE0039R	Grimsö	705	708	99.6	2380.5	2388.6	99.7
SI0008R	Iskrba	9255	9795.2	94.5	15740.8	16618.4	94.7
SI0031R	Zarodnje	14980.1	15143.2	98.9	24837.4	25445	97.6
SI0032R	Krvavec	16894.6	18012.2	93.8	27731.4	29486.2	94
SI0033R	Kovk	16911.9	17927.6	94.3	29131.2	31070.3	93.8
SK0002R	Chopok	7207.5	7779.9	92.6	12143	15576.2	78
SK0004R	Stará Lesná	3999.5	4153.9	96.3	8418	10829.2	77.7
SK0006R	Starina	3754.5	4255.6	88.2	5110	8108.1	63
SK0007R	Topolniky	4282	4324.6	99	6907.5	8892.9	77.7

Annex 3

Seasonal variation

Table 3.1: Monthly mean concentrations 2015 ($\mu g/m^3$).

Code	Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AT0002R	Illmitz	monthly mean	46.4	52	59.2	78.7	75.1	85.1	90.5	88.2	66.3	33.6	37	19.7
AT0002R	Illmitz	data capture	93.8	94.6	94.5	81.2	95.3	95.3	95.6	95.6	92.1	94.1	92.2	93.1
AT0005R	Vorhegg	monthly mean	64.8	71.9	80.7	91.8	79	79	81.4	71.5	59.1	38	51.1	55.2
AT0005R	Vorhegg	data capture	95.6	95.5	94.9	95.6	95.7	94.4	93.5	95.2	95.6	95.7	95.3	95.6
AT0030R	Pillersdorf bei Retz	monthly mean	42.5	52.2	61.1	76.5	73.8	81.7	92.1	94.1	62.4	35.4	42.6	23.4
AT0030R	Pillersdorf bei Retz	data capture	95.2	94.6	95.4	95.6	95.3	95.3	94.9	93.7	93.2	94.5	95.3	95
AT0032R	Sulzberg	monthly mean	66.8	74.4	83.4	97.2	94	101.1	115.5	108.1	71.8	48.3	62.2	70.2
AT0032R	Sulzberg	data capture	95.6	95.2	95.8	95.1	95.4	95.3	95.7	95.8	95.4	95	95.7	95.7
AT0034G	Sonnblick	monthly mean	85	93.7	104	112.2	110.7	113.8	117.4	117	98.3	87.6	82.4	93.4
AT0034G	Sonnblick	data capture	76.3	95.8	96.2	95.8	96	95.7	92.1	96.2	95.7	73.3	34.9	65.1
AT0038R	Gerlitzen	monthly mean	80.6	88.3	95.4	106.2	103.6	110.9	116.9	112.2	90.8	78.2	81.2	86.3
AT0038R	Gerlitzen	data capture	95.7	95.4	85.8	95.6	95.4	95.8	95.7	95.7	95.8	95.7	95.8	95.7
AT0040R	Masenberg	monthly mean	62.1	75.1	82.1	94.4	90.8	100.5	105.5	111.1	79	51.2	64.3	66.1
AT0040R	Masenberg	data capture	95.6	95.5	95.6	95.4	95.7	95.6	95	95.6	95.8	95.3	95.7	95.8
AT0041R	Haunsberg	monthly mean	56.3	58.5	72.2	84.4	79.9	91.4	105.3	98.7	65.2	37.1	52.6	49.6
AT0041R	Haunsberg	data capture	95.6	95.8	95.7	95.8	96.2	97.1	99.3	96	92.9	95.6	49	93
AT0043R	Forsthof	monthly mean	48.7	60.8	69.3	84.9	79.3	89.9	106.8	106.2	67.6	41.1	48.7	40.8
AT0043R	Forsthof	data capture	95.4	95.2	94.8	95.6	95.3	92.8	95	95.6	95.3	95.4	95.6	95.6
AT0045R	Dunkelsteinerwald	monthly mean	41.1	46.2	58.2	76	68.2	76.8	92.7	83.7	55.4	29.3	38	25
AT0045R	Dunkelsteinerwald	data capture	95	95.2	95.2	95.4	92.2	95.3	95.2	95.6	95.4	95.4	95.7	95.4
AT0046R	Gänserndorf	monthly mean	41.8	49.1	56.3	72.8	70.7	81.1	89.7	87.4	60.1	32.1	35	22.4
AT0046R	Gänserndorf	data capture	95.6	95.5	95.6	95.6	95.3	95.6	95.4	95.7	95.7	95.6	95	84.5
AT0047R	Stixneusiedl	monthly mean	44.8	52.9	60.1	76.7	70.9	80.6	92.1	91.6	61.8	32.6	41.8	22.1
AT0047R	Stixneusiedl	data capture	94.6	94.9	95.6	95.7	95.7	95.6	95.6	95.7	95.6	95.7	95.7	95.6
AT0048R	Zoebelboden	monthly mean	64.8	71.9	80.7	91.8	79	79	81.4	71.5	59.1	38	51.1	55.2
AT0048R	Zoebelboden	data capture	95.6	95.5	94.9	95.6	95.7	94.4	93.5	95.2	95.6	95.7	95.3	95.6
AT0049R	Grebenzen bei St. Lamprecht	monthly mean	78.2	87.5	93.3	103.2	98.6	105	108.4	107.6	85.9	74	78.5	84.2
AT0049R	Grebenzen bei St. Lamprecht	data capture	95.7	95.5	95.6	95.8	95.2	95.7	92.9	95.7	95.6	95.8	94.9	95.4
AT0050R	Graz Lustbuehel	monthly mean	35.5	50.4	71	83.5	73.7	83.2	85.2	88.8	61.7	33.4	28	12.3
AT0050R	Graz Lustbuehel	data capture	95.6	95.8	94.8	95.7	95.8	95.7	95.4	95.8	95.4	95.7	95.8	95
BG0053R	Rojen peak	monthly mean	76.1	79.9	85.2	96.3	93.3	92.6	104.7	106.5	94.2	-	73.5	77.1
BG0053R	Rojen peak	data capture	91.5	94.5	86.2	95.3	93.3	92.5	94.5	95	34.9	0	84.2	95.2

Table 3.1, cont.

Code	Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CH0001G	Jungfraujoch	monthly mean	62.7	66.2	73.4	78.6	79.6	83.5	88	84.6	74.4	68	64	67.6
CH0001G	Jungfraujoch	data capture	97.4	97.5	95.2	97.4	94.4	97.8	97.6	97	97.6	97.6	97.6	94.5
CH0002R	Payerne	monthly mean	39.8	43	51.8	68.7	71.9	76.9	91.6	75.9	55.1	30.3	32.1	13.1
CH0002R	Payerne	data capture	99.5	99.3	96	98.8	99.2	99.2	99.2	99.5	99	99.3	99.4	99.3
CH0003R	Tänikon	monthly mean	43.9	41.1	51.2	70.3	71.8	75.8	90.1	80.6	51.9	30.4	36.8	20.9
CH0003R	Tänikon	data capture	99.1	99.4	99.1	99.4	99.5	99.2	99.3	99.5	98.9	99.6	99.4	99.6
CH0004R	Chaumont	monthly mean	68.6	75.7	80.5	94.9	91.3	98.8	111.8	105.4	79.1	58	70.7	69.8
CH0004R	Chaumont	data capture	99.6	99.3	93.7	99.2	99.6	99.4	99.1	99.6	99.4	99.5	99.4	99.2
CH0005R	Rigi	monthly mean	66.1	74.6	79.2	93.6	90.5	98.1	112	102.8	72.8	51.3	67.3	73
CH0005R	Rigi	data capture	99.7	99.4	99.3	99.2	98	99.4	99.5	99.2	99.2	99.5	99.6	99.6
CY0002R	Ayia Marina	monthly mean	82.4	86.3	93.6	101.1	104	105.6	109	101.1	94.4	87.1	89.8	83.3
CY0002R	Ayia Marina	data capture	97	91.8	98.8	99.2	94.1	97.5	99.1	96.4	96.9	99.1	97.2	91.9
CZ0001R	Svratouch	monthly mean	50.9	59.5	63.4	72.6	77.5	85.8	100.4	110.6	73.2	48.4	54.3	43.6
CZ0001R	Svratouch	data capture	99.7	100	99.6	99.4	91.9	92.6	94.9	89.9	94.9	94.1	68.3	91.3
CZ0003R	Kosetice	monthly mean	51.8	61.8	67.2	77.9	79.9	71.5	94.6	99.4	65.3	40.6	46.8	43
CZ0003R	Kosetice	monthly mean	53.7	59.8	64.5	73.8	74.6	76.6	89.7	92.3	61.2	38	48.3	43.5
CZ0003R	Kosetice	data capture	100	100	100	95	84.4	45.1	100	93.8	100	100	74	84.5
CZ0003R	Kosetice	data capture	67.6	99.6	100	94.7	100	100	98.9	99.6	95.7	99.3	99.4	100
CZ0005R	Churanov	monthly mean	63.7	76.7	78.6	87.4	83.8	85.7	101.2	108.1	72.3	48.2	60.9	58.4
CZ0005R	Churanov	data capture	99.1	100	100	100	92.5	95.6	97.7	98	97.9	97	97.5	97.7
DE0001R	Westerland	monthly mean	59.9	58.8	68.8	80.7	83.7	74.6	78.9	76.4	67.3	50	55	50.8
DE0001R	Westerland	data capture	95.6	96	96	95.3	95.6	94.7	95	96	94.2	96	95.1	95.2
DE0002R	Waldhof	monthly mean	45.3	45.1	57.3	64.5	66.2	71.1	68.9	67.6	43.6	29.4	38.6	39.5
DE0002R	Waldhof	data capture	95.8	95.5	96	96	95.7	95.3	95.8	96	96	94.2	95.7	93.5
DE0003R	Schauinsland	monthly mean	68.4	78.7	77.4	92.8	90.2	104.1	118	115.4	73.3	57.5	-	-
DE0003R	Schauinsland	data capture	96	96	96	96	96	95.7	91.9	95.8	96	30.5	0	0
DE0007R	Neuglobsow	monthly mean	45.1	43.8	57.7	68.2	64.9	67.6	64.9	73	41	30.9	33.6	36.5
DE0007R	Neuglobsow	data capture	95.6	92.9	95.4	92.6	95.3	95.1	94.1	82.5	89.7	94.2	94.7	94
DE0008R	Schmücke	monthly mean	54.1	65.8	69.6	86.1	88.7	89	96.7	106	67.7	46.1	53.4	46.9
DE0008R	Schmücke	data capture	94.8	93	94.9	95.1	95.4	94.7	95.3	95.6	95.4	94.2	92.5	94.8
DE0009R	Zingst	monthly mean	51.3	51.4	68.7	74.1	76.8	71	72.5	76.4	57.5	47.8	43.6	47.2
DE0009R	Zingst	data capture	96	96	79.3	96.1	94.4	95	95.4	96	94.9	94.4	92.9	95

Table 3.1, cont.

Code	Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
DK0005R	Keldsnor	monthly mean	54.7	50.6	64.6	69	71.9	64.5	70.1	71.1	57.3	51.4	47.7	47.4
DK0005R	Keldsnor	data capture	91	91.1	90.5	91	68.7	81.5	90.3	90.6	91.2	89	89.3	91.5
DK0010G	Villum Research Station,	monthly mean	-	74.1	59.1	56	23.7	57.7	53	58.7	-	73.6	73.1	73.4
DK0010G	Station Nord	data capture	0	24.1	88	90.4	86.7	91.9	86.8	43.4	0	82.8	83.8	90.6
DK0012R	Risoe	monthly mean	54.9	52	63.4	74.1	79.4	70.3	73	75	59.2	48.4	46.7	50.2
DK0012R	Risoe	data capture	87.2	91.2	89	19.2	70.7	91.7	89.9	91.4	88.5	91.5	91.7	91.5
DK0031R	Ulborg	monthly mean	55.6	55.3	65.6	73.5	78.1	68.8	74.3	80	63.2	51.7	54.8	55.6
DK0031R	Ulborg	data capture	73.4	91.5	91	91.4	90.2	91.4	91.7	91.5	81.8	87.6	86.9	91.7
EE0009R	Lahemaa	monthly mean	52.7	56.7	64.2	70.2	70.2	62.1	52.8	51	42.9	41	40.1	52.2
EE0009R	Lahemaa	data capture	99.6	100	100	99.7	100	100	99.5	100	99.4	100	100	99.6
EE0011R	Vilsandi	monthly mean	61.4	57.2	69.6	75.7	83.1	77.4	72.2	75.8	64.5	58.3	57.8	59.7
EE0011R	Vilsandi	data capture	100	100	93.8	97.8	92.7	100	97.2	100	99.7	92.9	98.1	99.7
ES0001R	San Pablo de los Montes	monthly mean	69.2	70.5	80.5	97.5	107.3	123.3	117	104.1	102.2	79.5	75.9	72.1
ES0001R	San Pablo de los Montes	data capture	99.3	99	99.2	99.3	98.7	99.3	99.2	99.1	98.2	98.8	98.3	99.5
ES0005R	Noya	monthly mean	72.6	78.1	83.5	84.8	75.5	81.4	57.3	60	74.8	76.5	66.5	68.6
ES0005R	Noya	data capture	97.7	96.3	94.5	99.3	94	92.4	99.1	99.2	97.6	79	94.9	95.7
ES0006R	Mahón	monthly mean	50.3	72.8	87	90.5	98.3	99.1	87.2	67	68.4	66.4	65.6	70.9
ES0006R	Mahón	data capture	96.4	97.8	98	96.9	98.4	98.9	98.7	98.7	97.5	91.4	98.9	99.1
ES0007R	Víznar	monthly mean	62.5	64.7	85.3	103	104.8	112.7	108.9	88.1	85.4	76.7	56.7	68.3
ES0007R	Víznar	data capture	95.6	99.1	95.2	73.3	98.1	91	93.8	98.9	99.2	99.3	98.2	97.4
ES0008R	Niembro	monthly mean	61.3	71.7	78.5	88.2	79.7	74.9	69.7	73.8	74.5	71	59.4	61.2
ES0008R	Niembro	data capture	99.2	98.4	98.9	99.3	93.1	97.8	98.4	99.5	99.2	98.7	95.4	96.1
ES0009R	Campisabalos	monthly mean	60.3	72.4	69	75.3	72.5	79	82.6	74.1	66.4	67	50	52.5
ES0009R	Campisabalos	data capture	99.1	98.8	96.1	98.5	99.5	99.3	93.4	98	98.1	98.7	98.9	98.8
ES0010R	Cabo de Creus	monthly mean	57.4	60.3	70.7	80	74.7	89.5	81	77.2	78.1	66.8	58.2	51.8
ES0010R	Cabo de Creus	data capture	97.4	93.6	84.3	98.5	99.1	99	92.1	74.2	99	99.1	97.8	97.8
ES0011R	Barcarrota	monthly mean	55.6	70.5	61.6	56.1	71.3	79.5	64.4	62.9	44.7	34.2	32.5	29
ES0011R	Barcarrota	data capture	99.1	99	87.1	80.1	99.3	92.9	96.9	98.4	99.3	91.4	97.6	99.3
ES0012R	Zarra	monthly mean	69.8	76.4	88.7	93.9	102.6	114	109.4	87.3	88.1	74	69.1	71.3
ES0012R	Zarra	data capture	99.3	99	98.4	98.6	98.7	98.2	98.8	98	98.6	98.3	98.8	98.8
ES0013R	Penausende	monthly mean	62.9	69.5	73.8	76.2	79.2	89.5	80.9	77.2	76.7	68.5	55.8	53.2
ES0013R	Penausende	data capture	99.2	98.5	98.8	98.9	98.4	96.5	97.8	98.7	92.6	95.8	96.2	98.7
ES0014R	Els Torms	monthly mean	54.8	67.4	78.5	92	93.7	103.7	95.2	85.2	81	71.3	47.6	34.9
ES0014R	Els Torms	data capture	98.9	98.7	98.5	96.7	94.6	99.2	98.1	98.7	98.8	99.3	98.6	98.3

Table 3.1, cont.

Code	Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ES0016R	O Saviñao	monthly mean	60.9	67.2	69.7	67.2	68.2	70	58.3	57.4	57.3	49.9	34.7	46.7
ES0016R	O Saviñao	data capture	83.1	93	99.1	99.3	99.2	93.1	98.5	96.6	99.3	98.5	98.5	99.3
ES0017R	Doñana	monthly mean	46.7	62.4	60.7	72.4	84.2	83.8	71.7	73.2	68.6	55.6	48.6	37.9
ES0017R	Doñana	data capture	99.3	99.3	99.3	99.4	96.6	99.3	98.8	98.5	98.5	99.1	98.9	99.2
FI0009R	Utö	monthly mean	62.7	62.8	70.9	77.7	75.4	71.5	67.1	74.5	64.9	63.6	57.8	62.2
FI0009R	Utö	data capture	98.9	96.9	100	99.3	99.6	100	100	100	100	99.9	97.2	99.7
FI0018R	Virolahti III	monthly mean	52.4	56.3	62.1	64.4	65.8	60.2	48.9	47.8	38.2	40.7	36.9	49.4
FI0018R	Virolahti III	data capture	90.5	99.9	99.3	99.4	100	100	100	99.3	97.5	99.3	100	99.5
FI0022R	Oulanka	monthly mean	58.1	71.4	74	73.5	68.1	56.8	42.4	46.6	45.1	47.9	45.7	61.1
FI0022R	Oulanka	data capture	99.1	100	100	100	99.7	99.3	100	96.9	100	99.2	100	99.3
FI0037R	Ähtäri II	monthly mean	54.4	66.7	70.4	73.5	67.9	54.5	42.9	45.9	38.9	45.2	41.7	52.7
FI0037R	Ähtäri II	data capture	96	99.6	100	97.8	97.2	86.8	99.9	99.9	100	99.6	86.4	99.5
FI0096G	Pallas (Sammaltunturi)	monthly mean	64.8	75.8	80.6	82.2	74.5	66.7	52.6	56.3	55	59.4	54.7	67.8
FI0096G	Pallas (Sammaltunturi)	data capture	99.1	100	100	100	100	99	100	100	100	99.3	96.8	98.4
FR0008R	Donon	monthly mean	52.7	55.1	60.3	77.1	70.7	71.8	84.5	80.5	54.6	32.2	47.6	47
FR0008R	Donon	data capture	99.3	99.9	99.6	99.3	100	99.9	99.7	100	100	98.9	100	99.7
FR0009R	Revin	monthly mean	46.9	50.8	60.3	75.1	70.9	82.3	74	74.8	55.2	33.7	47	45.8
FR0009R	Revin	data capture	99.1	99.4	99.3	99.7	99.6	91.1	84.5	99.6	99.6	100	98.9	100
FR0010R	Morvan	monthly mean	59.3	65.2	66.3	82	78.2	82.3	87.8	89	66.3	53.3	60	59.7
FR0010R	Morvan	data capture	66.5	90.2	97.8	98.3	94.9	90.8	98.4	91.7	92.8	98.3	97.9	88
FR0013R	Peyrusse Vieille	monthly mean	60.5	69.6	73.9	79.5	73	83.9	74.5	77.6	67.9	58.1	53.3	52.2
FR0013R	Peyrusse Vieille	data capture	99.6	99.3	97.4	52.6	99.9	100	98.7	100	91.1	77.2	100	90.1
FR0014R	Montandon	monthly mean	51	52.4	54.1	69.4	62.9	76.6	91.6	84.1	63	36.9	50	47.3
FR0014R	Montandon	data capture	98.7	99.9	99.6	99.6	99.9	99.7	98.7	87	99.7	99.6	99.4	99.3
FR0015R	La Tardière	monthly mean	47.5	58.1	61.5	75.1	67.4	73.6	64.9	63.7	59.2	47.1	46.2	45.3
FR0015R	La Tardière	data capture	77.4	100	99.6	99.9	90.5	99.9	99.6	99.2	98.5	99.1	76.4	96.1
FR0016R	Le Casset	monthly mean	79.7	87.3	95.1	100.3	96.7	102.8	115.7	97.1	89.4	74.9	80.8	79.5
FR0016R	Le Casset	data capture	100	99.9	100	100	100	98.1	78.6	100	92.1	99.9	99.9	99.9
FR0017R	Montfranc	monthly mean	67.4	73.1	78.3	88.2	88.6	87.5	89.1	87.8	75	63	66.3	70.8
FR0017R	Montfranc	data capture	99.7	100	99.3	99.9	99.1	98.9	99.3	99.1	91.5	99.9	99.9	99.3
FR0018R	La Coulonche	monthly mean	59.2	61.9	67.8	79.4	74.7	78.9	68.1	71	67	56.5	61.3	55.3
FR0018R	La Coulonche	data capture	99.9	99	98.3	99.7	84.8	99.4	97.2	100	99.4	99.7	99.9	99.7
FR0019R	Pic du Midi	monthly mean	87.5	87.4	77	79.9	74	82.4	100.3	99.9	96.2	84.6	83.3	86.7
FR0019R	Pic du Midi	data capture	99.9	99.9	99.7	99.9	99.7	99.9	99.2	99.9	99.9	99.7	99	96

Table 3.1, cont.

Code	Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
FR0023R	Saint-Nazaire-le-Désert	monthly mean	53	58.5	62.5	77.8	79.8	80.3	95.7	77.6	65.1	41.2	41.4	39.1
FR0023R	Saint-Nazaire-le-Désert	data capture	98.4	98.7	98.3	97.9	98.4	86.4	91.1	98.7	98.1	98.4	93.1	82.4
FR0025R	Verneuil	monthly mean	46.8	55.1	57.3	69.6	65.3	69.8	72.5	67.9	55.9	42.4	46.8	39.7
FR0025R	Verneuil	data capture	99.3	91.4	99.7	100	99.6	100	99.9	99.7	99.6	99.9	99.7	99.7
FR0030R	Puy de Dôme	monthly mean	79.8	85.9	92	99.7	96.3	105.2	103.8	104.4	88.5	80.4	76.3	85
FR0030R	Puy de Dôme	data capture	96.4	78.6	97.6	97.4	93.5	83.8	90.7	97.7	95.3	98	97.4	98
GB0002R	Eskdalemuir	monthly mean	64.5	61.3	65.2	62.6	70.3	57.3	51.1	51.2	46.8	41.2	53.7	56.1
GB0002R	Eskdalemuir	data capture	99.6	100	100	95.3	100	100	95.3	100	100	99.5	100	100
GB0006R	Lough Navar	monthly mean	63.2	57.7	68	64.7	66.9	51.5	41.3	38.8	45.7	41.4	55.6	59
GB0006R	Lough Navar	data capture	97	96.6	99.1	99.7	100	99.4	100	99.7	97.1	98.7	99.6	99.2
GB0013R	Yarner Wood	monthly mean	77.6	68.3	68.9	79.3	80	70	53.7	53.5	57.1	46.4	60.4	68.1
GB0013R	Yarner Wood	data capture	100	86.6	100	99.9	100	99	95.7	98.7	98.9	99.2	99.2	100
GB0014R	High Muffles	monthly mean	73.7	77.7	67.4	71.7	74.4	65.7	61.2	57.1	57.4	50	51.8	60.1
GB0014R	High Muffles	data capture	93.4	95.4	100	99.7	87.4	98.2	98.9	96.2	98.9	99.7	100	42.1
GB0015R	Strath Vaich Dam	monthly mean	80.1	79.2	79.2	81.1	80.5	64.2	57.3	61.8	66.2	57.5	69.6	68.8
GB0015R	Strath Vaich Dam	data capture	94.6	97	96.5	98.6	100	99.7	99.1	99.2	100	99.9	99.3	100
GB0031R	Aston Hill	monthly mean	67	65	69.6	74.9	71.9	65	60.5	59.7	61.2	55.4	64.3	70
GB0031R	Aston Hill	data capture	100	95.2	99.9	100	99.9	99.6	96.1	100	91.8	96	100	100
GB0033R	Bush	monthly mean	66.5	63.5	69.7	70	72.4	59	53.5	55.1	50.2	44.2	50.5	54.7
GB0033R	Bush	data capture	99.6	96.3	100	99.9	100	100	99.6	96.2	100	99.9	100	100
GB0035R	Great Dun Fell	monthly mean	67.5	69.9	70	72.5	68.1	-	39.8	47.8	45.4	40.9	57.2	55.5
GB0035R	Great Dun Fell	data capture	99.7	99.6	99.6	99.3	9.8	0	46.5	100	100	99.5	98.3	100
GB0036R	Harwell	monthly mean	56.5	52	60.3	64.4	67.1	62.7	57.6	54.1	50.2	43.9	53.9	61.8
GB0036R	Harwell	data capture	99.5	92.6	99.9	99.6	100	96.1	91.8	100	97.6	99.7	100	99.9
GB0038R	Lullington Heath	monthly mean	52	50	55.8	62.4	63.1	65.7	59.2	57.1	52.4	44.7	56.5	60.9
GB0038R	Lullington Heath	data capture	99.6	96.4	100	99.7	93.4	100	96	99.7	100	100	99.7	98.5
GB0039R	Sibton	monthly mean	49.2	50.5	57.8	63.5	62.6	61.4	59.8	57.7	52.1	43.2	47	52.6
GB0039R	Sibton	data capture	100	98.7	100	99.9	100	99.9	99.9	100	99.6	99.5	99.9	100
GB0043R	Narberth	monthly mean	67	64.1	69.6	71.3	66.9	60	56.1	54	56.5	56.1	62.8	71.4
GB0043R	Narberth	data capture	97.2	95.7	100	99.4	100	99.7	99.2	100	99.9	96.1	100	99.7
GB0045R	Wicken Fen	monthly mean	46.5	47.2	58.9	62.7	64.1	61.4	58.5	57.2	51.4	42.4	48.9	54.1
GB0045R	Wicken Fen	data capture	99.7	95.8	99.9	99.7	99.7	99.7	94.6	100	100	98.8	100	100
GB0048R	Auchencorth Moss	monthly mean	63.3	59.3	64	65.7	68.5	58.2	56	58	54.8	50.2	57.7	61.5
GB0048R	Auchencorth Moss	data capture	97.2	95.5	100	99.9	100	100	99.6	96.2	100	99.7	99.9	100
GB0049R	Weybourne	monthly mean	53.2	57.2	64.7	75.4	73.6	69.3	67.4	65.7	63.8	56.2	50.6	55.4
GB0049R	Weybourne	data capture	100	99.4	100	99.7	100	100	99.6	100	100	99.7	100	100

Table 3.1, cont.

Code	Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
GB0050R	St. Osyth	monthly mean	49.3	49.9	56	61.4	62.7	55.8	55.2	55.6	49.2	38.2	45.4	51
GB0050R	St. Osyth	data capture	98.5	99.3	78.9	99	99.3	99.4	98	58.5	99.4	95.2	99.4	100
GB0052R	Lerwick	monthly mean	74.6	76.3	78.3	77.8	77.3	66.9	59.6	65.7	68.6	67.3	67.8	67.9
GB0052R	Lerwick	data capture	33.3	100	99.9	87.5	99.9	85.7	97.4	100	100	98.8	99.4	100
GB0053R	Charlton Mackrell	monthly mean	67.1	63.8	70.5	71.3	74.1	68.3	59	53.9	52.8	46.8	58	67.9
GB0053R	Charlton Mackrell	data capture	99.9	99.6	99.6	99.7	100	99.6	99.5	100	100	99.7	100	100
GR0001R	Aliartos	monthly mean	41.6	46.9	41.5	68.6	73.2	70.9	77.5	79.6	68.3	51	42.6	20.5
GR0001R	Aliartos	data capture	93.1	99.1	97.3	98.1	96.5	50.8	99.3	99.9	100	98.9	98.9	99.3
GR0002R	Finokalia	monthly mean	82.4	84	90.8	98	101.9	107.8	112.3	110.7	106.4	82	86.4	80.4
GR0002R	Finokalia	data capture	83.2	76	99.6	99.2	98.1	99.7	99.2	89.4	66.7	97.6	99.9	98.3
HU0002R	K-puszta	monthly mean	36.9	44.3	57.9	72.4	61.4	66.1	68.2	57	49.3	-	-	19.9
HU0002R	K-puszta	data capture	100	99.4	100	76.7	100	99.9	100	100	75.6	0	0	100
IE0001R	Valentia Observatory	monthly mean	81.6	75.1	80.5	78.6	78.4	60	59.1	59	69.1	68.2	72.2	74.9
IE0001R	Valentia Observatory	data capture	99.9	100	100	100	100	100	99.7	100	100	100	100	99.6
IE0031R	Mace Head	monthly mean	82.1	79.6	82.4	83.6	81.1	67.6	65.7	69.6	72.3	70	77.6	78
IE0031R	Mace Head	data capture	100	99.9	100	100	100	100	100	100	100	100	100	100
IT0001R	Montelibretti	monthly mean	26.2	36.5	42.1	49.2	48.9	66.6	70.7	66.3	48.1	31.1	22.6	-
IT0001R	Montelibretti	data capture	100	97.6	99.9	100	97.7	80.4	97.4	44.9	98.2	100	99	0
IT0004R	Ispra	monthly mean	22.7	27.4	55.1	73.3	72	90.2	105.5	75.9	47.1	21.8	11.2	3.5
IT0004R	Ispra	data capture	99.9	83.6	65.6	99.9	87.5	98.8	69.2	88.7	100	100	99.9	100
LT0015R	Preila	monthly mean	55.1	51.4	61.8	64.8	71.1	73.2	73.3	77.9	56.8	39.6	46.8	53
LT0015R	Preila	data capture	79.2	100	94.2	99.9	97.8	100	99.2	98.8	100	96	99.6	99.9
LV0010R	Rucava	monthly mean	54	55.5	63.4	78.1	76.6	71.5	64.2	66.6	45.9	-	51.1	56.5
LV0010R	Rucava	data capture	56.9	99.9	99.5	100	100	100	100	99.5	91.7	0	87.6	98.4
LV0016R	Zoseni	monthly mean	53.5	53.6	64.4	70.5	66.2	60.5	51.5	44.9	40.4	31.1	39.6	47.1
LV0016R	Zoseni	data capture	80.8	99.9	99.9	99.7	100	100	100	99.9	100	95.2	98.3	98
MK0007R	Lazaropole	monthly mean	87.5	121.1	107.9	110.7	94.2	104.6	96.7	89.1	79.7	61.9	76.2	79.6
MK0007R	Lazaropole	data capture	9.1	37.9	97	85	85.1	96.8	93.7	83.7	97.5	82.8	88.5	99.7
MT0001R	Giordan lighthouse	monthly mean	78.8	83	91.8	98	106.4	100.2	96.5	96.8	90.9	84.4	80.7	87.2
MT0001R	Giordan lighthouse	data capture	99.7	99.4	99.7	97.8	87.4	96.1	99.6	96.4	80.4	56.2	99.7	99.7
NL0007R	Eibergen	monthly mean	36.1	35.8	44.1	57.9	57.9	57.7	57.7	55.4	34.3	15.5	29.7	30.9
NL0007R	Eibergen	data capture	98.9	99	98	99	81.3	97.9	98.9	98.9	97.9	98.8	98.9	98.4

Table 3.1, cont.

Code	Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NL0009R	Kollumerwaard	monthly mean	50	49.5	56.3	63.8	65.3	60.5	63.4	59.4	48.9	29.3	42.6	36
NL0009R	Kollumerwaard	data capture	98.9	97.9	98.3	99	98	94.2	98.9	98.9	98.5	94.2	98.9	98.7
NL0010R	Vredepeel	monthly mean	38.2	34.8	43.6	57.3	60.8	66.1	63.6	59.3	38.7	16	36.5	38.3
NL0010R	Vredepeel	data capture	98.7	97.9	98.4	98.2	97.8	93.5	94.4	98.8	99.9	99.6	84.6	100
NL0091R	De Zilk	monthly mean	47.1	44.5	52.4	63.2	71	67.1	67.1	62.7	51.8	26.7	45.8	37.7
NL0091R	De Zilk	data capture	98.5	98.7	98.4	98.6	92.9	96.2	98.8	98.3	98.5	98.8	98.6	97.7
NL0644R	Cabauw Wielsekade	monthly mean	34.8	32.4	42.4	53.1	59.8	63.1	60.6	56.1	40.7	18.8	36.7	31.6
NL0644R	Cabauw Wielsekade	data capture	99.1	99	98.5	98.5	98.1	97.9	97.7	97.4	98.3	94.2	90.4	98.7
NO0002R	Birkenes II	monthly mean	65.2	67.4	72.2	80	75.5	66.9	63.3	65.4	55.1	50.6	55.7	56.6
NO0002R	Birkenes II	data capture	99.5	99.6	99.3	99	99.7	99	97.8	99.9	99.7	99.3	98.8	99.6
NO0015R	Tustervatn	monthly mean	69.5	70.1	80.4	83.7	75.6	65.5	53.3	56.3	57.5	60.7	64	75.7
NO0015R	Tustervatn	data capture	95.3	12.2	99.5	99	98.8	97.8	98.4	96.5	99.6	98.7	98.6	98.3
NO0039R	Kårvatn	monthly mean	65.4	64.9	71.5	67.9	63.5	49.7	37.1	46	42.7	30.9	38.8	55.6
NO0039R	Kårvatn	data capture	99.2	100	99.6	99.2	99.6	99.9	99.2	99.3	97.2	84.9	99.7	99.1
NO0042G	Zeppelin mountain (Ny-Ålesund)	monthly mean	76.4	73.1	78.3	73	65.1	59.5	54.4	59.2	64.5	70.5	69.4	70.3
NO0042G	Zeppelin mountain (Ny-Ålesund)	data capture	99.9	99.7	99.3	99.9	99.2	99.3	99.1	99.3	99.7	99.5	99.2	99.5
NO0043R	Prestebakke	monthly mean	59.7	60.4	67.1	76.4	71.8	64.8	58.6	65	51.8	47.2	49.5	54.3
NO0043R	Prestebakke	data capture	99.1	99.9	99.9	99.9	99.6	99	99.5	99.9	99.7	100	99.9	99.6
NO0052R	Sandve	monthly mean	70.6	64.5	70.5	73.6	75.4	67.1	65.3	73.5	59.6	55.1	61.1	61.5
NO0052R	Sandve	data capture	73	98.1	99.2	99.2	99.6	98.9	75.7	81.6	99.3	99.5	99	98.7
NO0056R	Hurdal	monthly mean	51.8	54.8	65.1	78.6	67.6	64.6	54.9	58.3	50	40.8	37.9	50.2
NO0056R	Hurdal	data capture	98.9	99.1	99.5	98.1	99.6	99.4	99.6	99.3	99.9	99.5	99.2	47.4
PL0002R	Jarczew	monthly mean	39.6	41	55.1	65.8	61.8	64.1	65.9	77.2	48.3	37.4	30.4	31.4
PL0002R	Jarczew	data capture	100	100	99.3	100	99.7	100	99.3	99.9	100	100	100	100
PL0003R	Sniezka	monthly mean	69	81.2	81.2	91.8	94.7	94.9	98.2	116.8	79.3	70.4	66.3	68.2
PL0003R	Sniezka	data capture	99.7	99.7	99.5	99.7	99.7	99.7	99.7	99.3	98.9	99.7	99.7	99.7
PL0004R	Leba	monthly mean	54.8	53.4	66.3	76.5	79.7	72.3	72.7	76	60.1	47.8	44.3	49.9
PL0004R	Leba	data capture	96.5	100	99.5	100	100	99.6	100	100	100	100	100	100
PL0005R	Diabla Gora	monthly mean	45	46.3	65	72.4	68.9	68.3	69.9	73.4	49.9	37.8	37.2	38.9
PL0005R	Diabla Gora	data capture	100	100	100	100	100	100	100	100	100	100	100	96.1
RS0005R	Kamenicki vis	monthly mean	21.1	75.6	76.3	97.7	93.3	97.5	115.9	109.3	85.8	58.6	-	-
RS0005R	Kamenicki vis	data capture	44.2	73.4	92.9	97.6	100	99.3	99.7	93	99.4	77.2	0	0
SE0005R	Bredkälen	monthly mean	59.2	72.6	78.5	81.5	64.6	60.4	44.2	52.6	48.5	46.4	49.9	62.2
SE0005R	Bredkälen	data capture	99.6	99.7	99.9	100	99.6	100	99.1	100	99.6	100	100	99.1

Table 3.1, cont.

Code	Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SE0011R	Vavihill	monthly mean	52.2	52.1	65.6	72	71.7	62.7	63.7	68.9	52.5	49.6	42.9	47.5
SE0011R	Vavihill	data capture	99.7	100	100	100	100	99.9	99.3	100	100	100	98.5	93.7
SE0012R	Aspvreten	monthly mean	50.9	53.9	59.5	66.1	59.5	58.7	50.8	53	44.7	41.4	37.8	51.7
SE0012R	Aspvreten	data capture	98.8	100	92.2	97.5	89.8	81.7	83.7	95.6	100	100	100	92.2
SE0013R	Esrange	monthly mean	65.9	78.3	83.2	83	76.3	64.7	52.6	55.3	54.4	58.6	53.7	70.2
SE0013R	Esrange	data capture	99.7	100	100	100	99.7	100	99.3	100	99.7	100	100	99.3
SE0014R	Råö	monthly mean	60.6	56.9	68.1	75.6	79.7	69.2	70.2	74.5	61.7	55.1	54.9	55.7
SE0014R	Råö	data capture	99.6	100	99.7	99.7	99.7	100	90.7	100	99.9	99.6	100	99.2
SE0018R	Asa	monthly mean	52.5	53.3	62.6	67.4	67.4	62.2	60.6	56	47	44.5	47.4	50.8
SE0018R	Asa	data capture	97.7	99.6	99.9	99.6	99.7	96.2	89.2	100	99.4	100	100	99.1
SE0019R	Östad	monthly mean	55	53.3	61	67.5	70.4	59.3	55.9	57	47.7	43.2	48.2	51
SE0019R	Östad	data capture	99.6	100	100	100	99.7	100	98.9	100	99.7	100	100	99.2
SE0032R	Norra-Kvill	monthly mean	58.5	60.9	73.1	78.9	75.3	69.2	64.2	69.9	58.6	55.2	51.3	58.3
SE0032R	Norra-Kvill	data capture	99.5	100	100	99.9	99.7	100	99.2	100	99.7	100	100	99.2
SE0035R	Vindeln	monthly mean	53.9	67.1	71.2	75.5	65.8	59.4	43.4	45.5	42.2	39.6	42.4	52.2
SE0035R	Vindeln	data capture	99.7	99.7	100	100	99.5	100	99.3	99.9	99.7	99.9	99.7	99.3
SE0039R	Grimsö	monthly mean	57.6	61.5	64	74.7	67.5	61.3	46.6	58.4	46.7	41.3	40.9	50.6
SE0039R	Grimsö	data capture	99.6	100	100	100	99.7	100	98.9	100	99.4	100	100	99.2
SI0008R	Iskrba	monthly mean	43.9	53.7	63.7	73.2	66.9	64.9	59.6	50.2	43.7	31.5	34.4	25.1
SI0008R	Iskrba	data capture	96	95.5	95.7	95.4	94.4	93.3	94.4	96.2	95.8	94.9	95.7	96.5
SI0031R	Zarodnje	monthly mean	62.1	78.5	90.1	102.3	98.7	105.6	108.2	109.7	85.3	54.1	57.7	49.1
SI0031R	Zarodnje	data capture	92.7	95.2	95.7	95.6	95.2	95.1	95.6	95.2	91.7	95.6	95.1	95.3
SI0032R	Krvavec	monthly mean	83.6	95.7	103.1	111	112.1	110.6	120.5	113.3	89.9	77.4	78.3	82.4
SI0032R	Krvavec	data capture	94.9	93.8	94.5	96	95.6	95.4	92.9	92.7	95.7	82.8	95.7	96
SI0033R	Kovk	monthly mean	-	-	101.8	116.6	106.6	110.9	114.8	111.1	90.8	60.1	67.6	54.7
SI0033R	Kovk	data capture	0	0	94.9	96	96	95.8	94.8	85.8	95.6	96.1	91.9	96
SK0002R	Chopok	monthly mean	67.6	79.6	82.2	88.9	91.4	91	99.5	108	-	-	-	-
SK0002R	Chopok	data capture	100	100	99.6	100	99.9	76.9	99.9	71.4	0	0	0	0
SK0004R	Stará Lesná	monthly mean	52.4	69.8	75.2	86.6	68.7	67.1	68.2	80.4	-	-	-	-
SK0004R	Stará Lesná	data capture	100	100	99.7	100	100	89.3	100	59.4	0	0	0	0
SK0006R	Starina	monthly mean	48	61.7	65.2	74.3	62.7	70.3	71	-	-	-	-	-
SK0006R	Starina	data capture	99.7	99.1	99.6	99.6	99.1	98.1	66	0	0	0	0	0
SK0007R	Topolniky	monthly mean	36.5	46.6	49.5	61.5	56.3	62.6	67.4	76.1	-	-	-	-
SK0007R	Topolniky	data capture	100	99.9	99.9	99.6	98.3	99.2	100	50.5	0	0	0	0

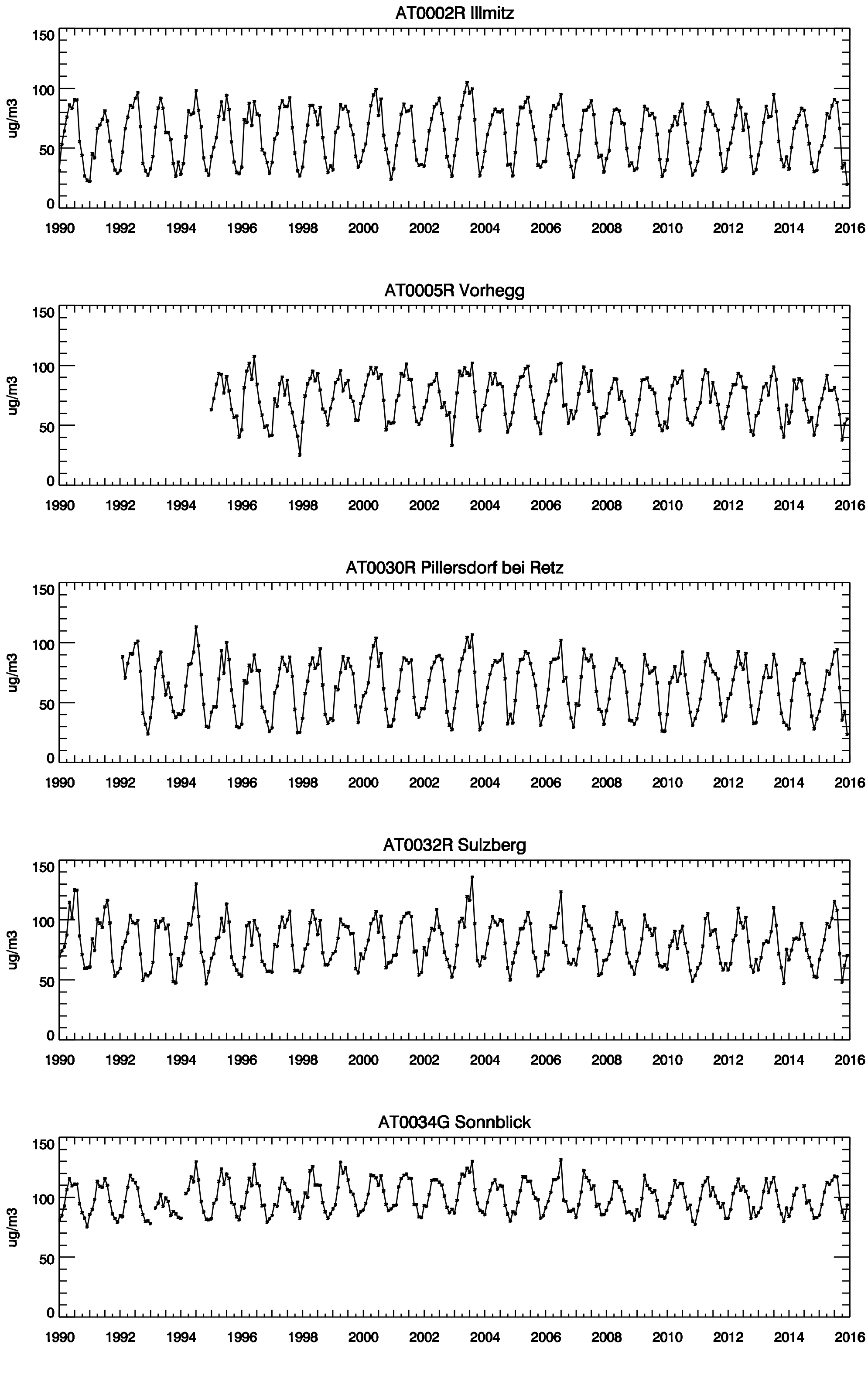


Figure 3.1: Seasonal variation, 1990–2015.

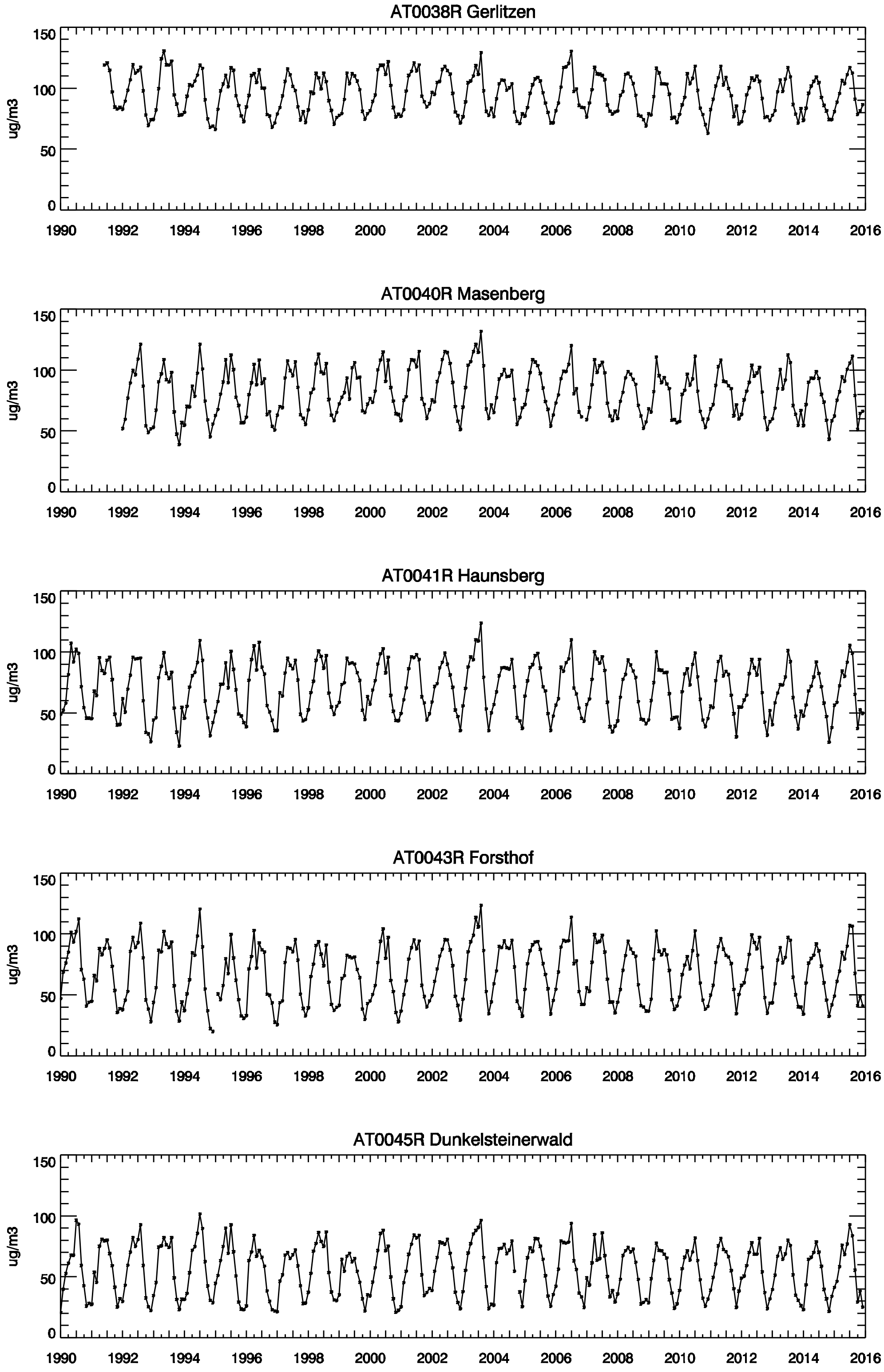


Figure 3.1, cont.

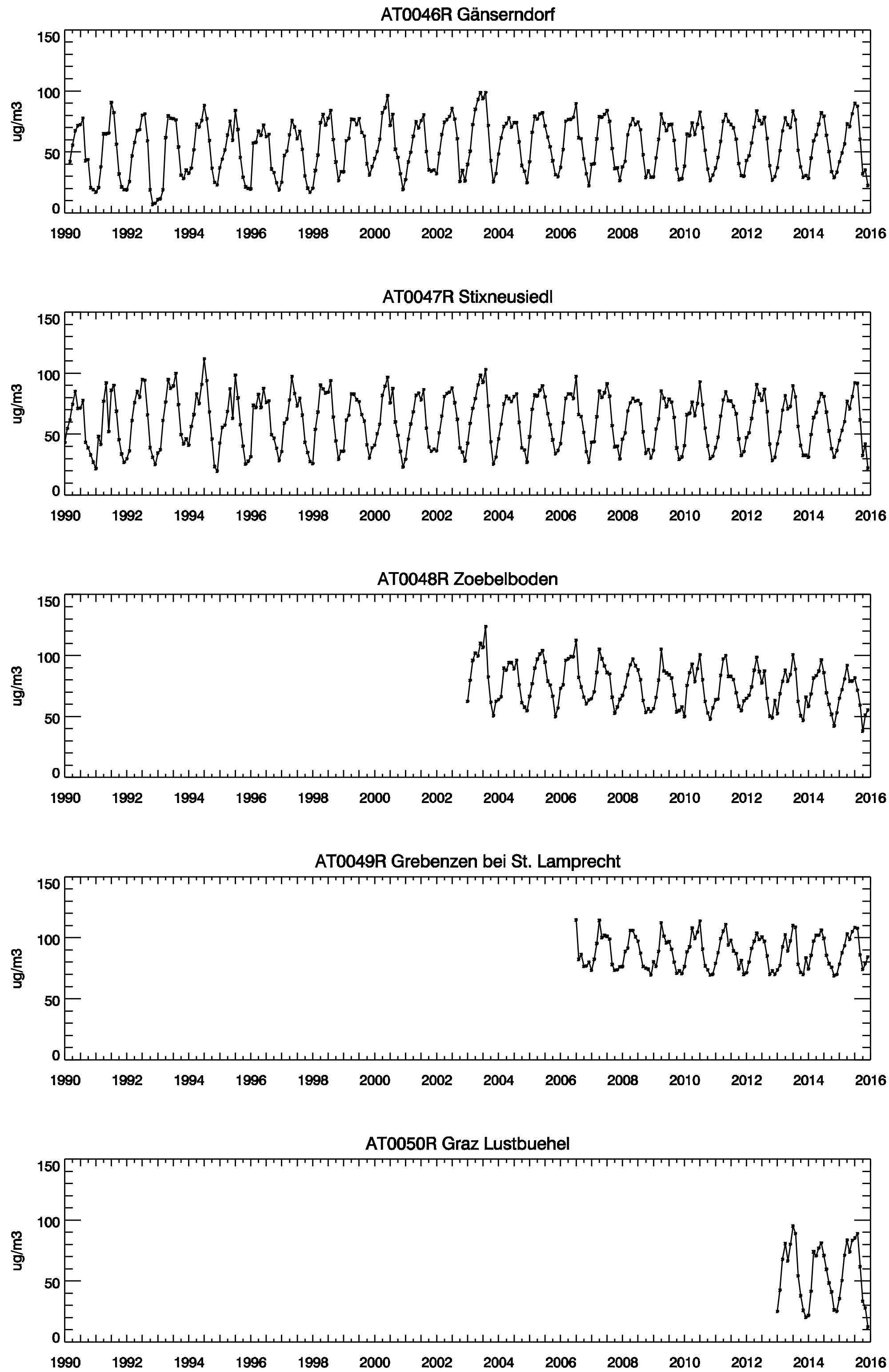


Figure 3.1, cont.

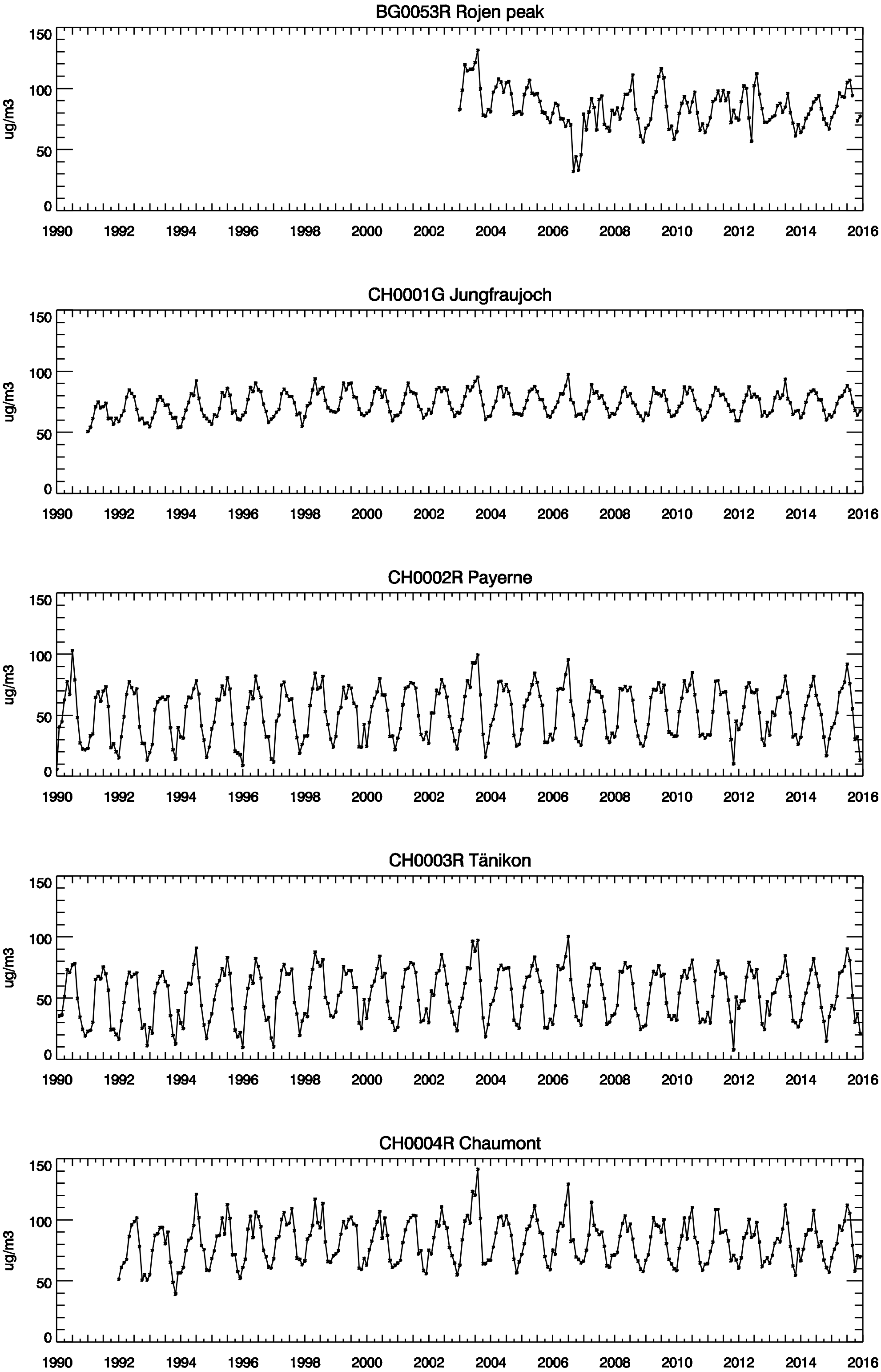


Figure 3.1, cont.

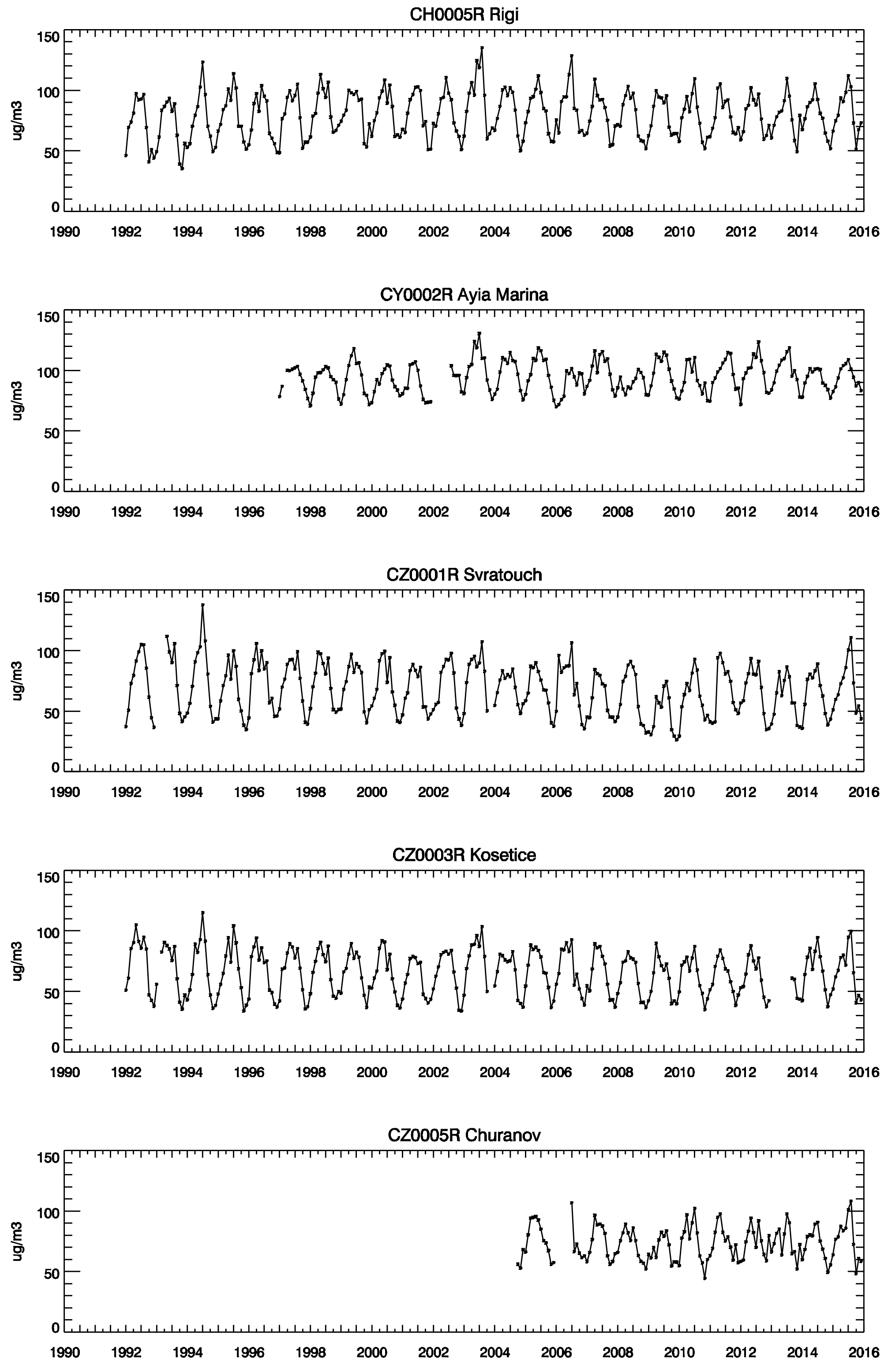


Figure 3.1, cont.

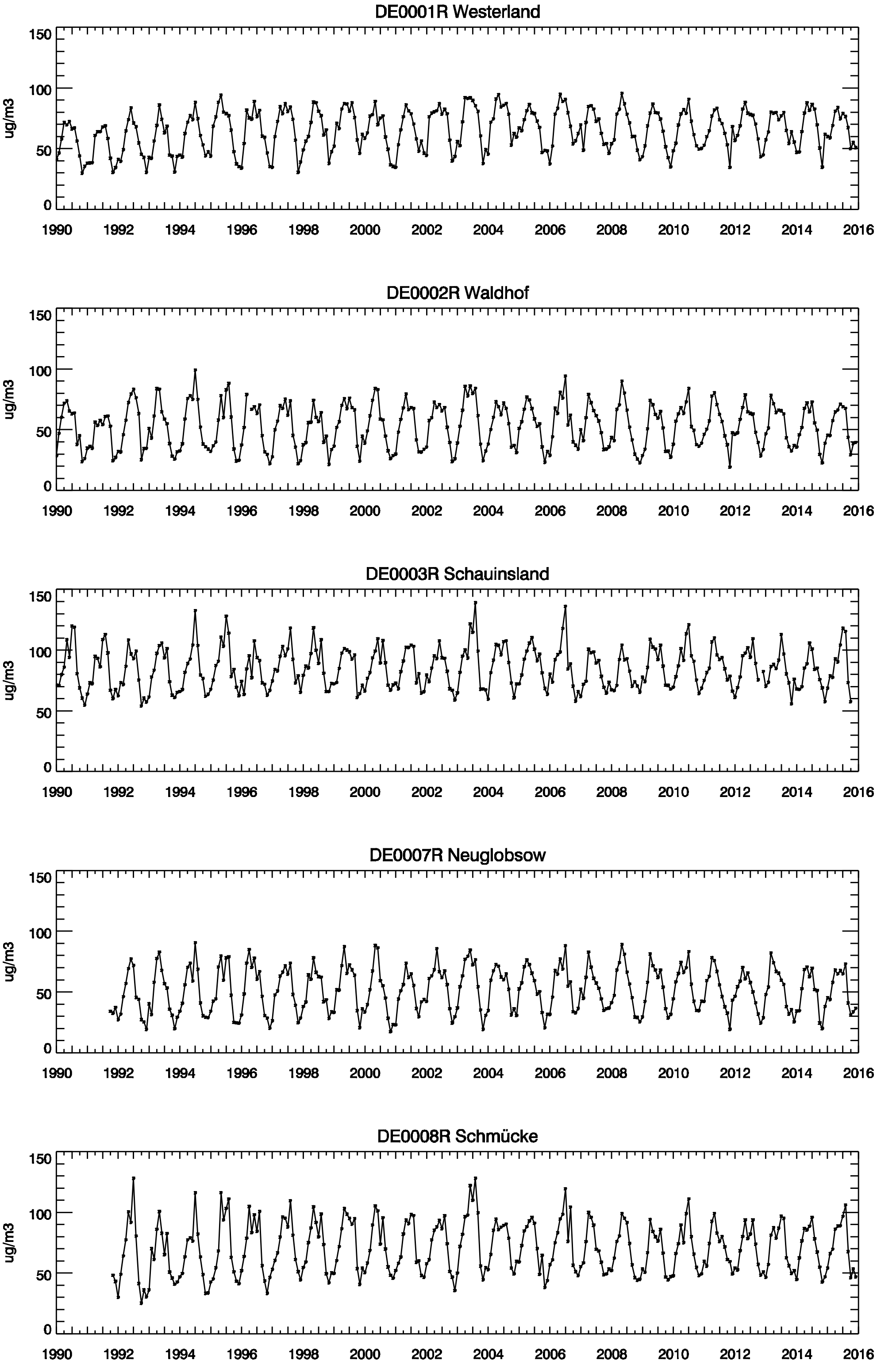


Figure 3.1, cont.

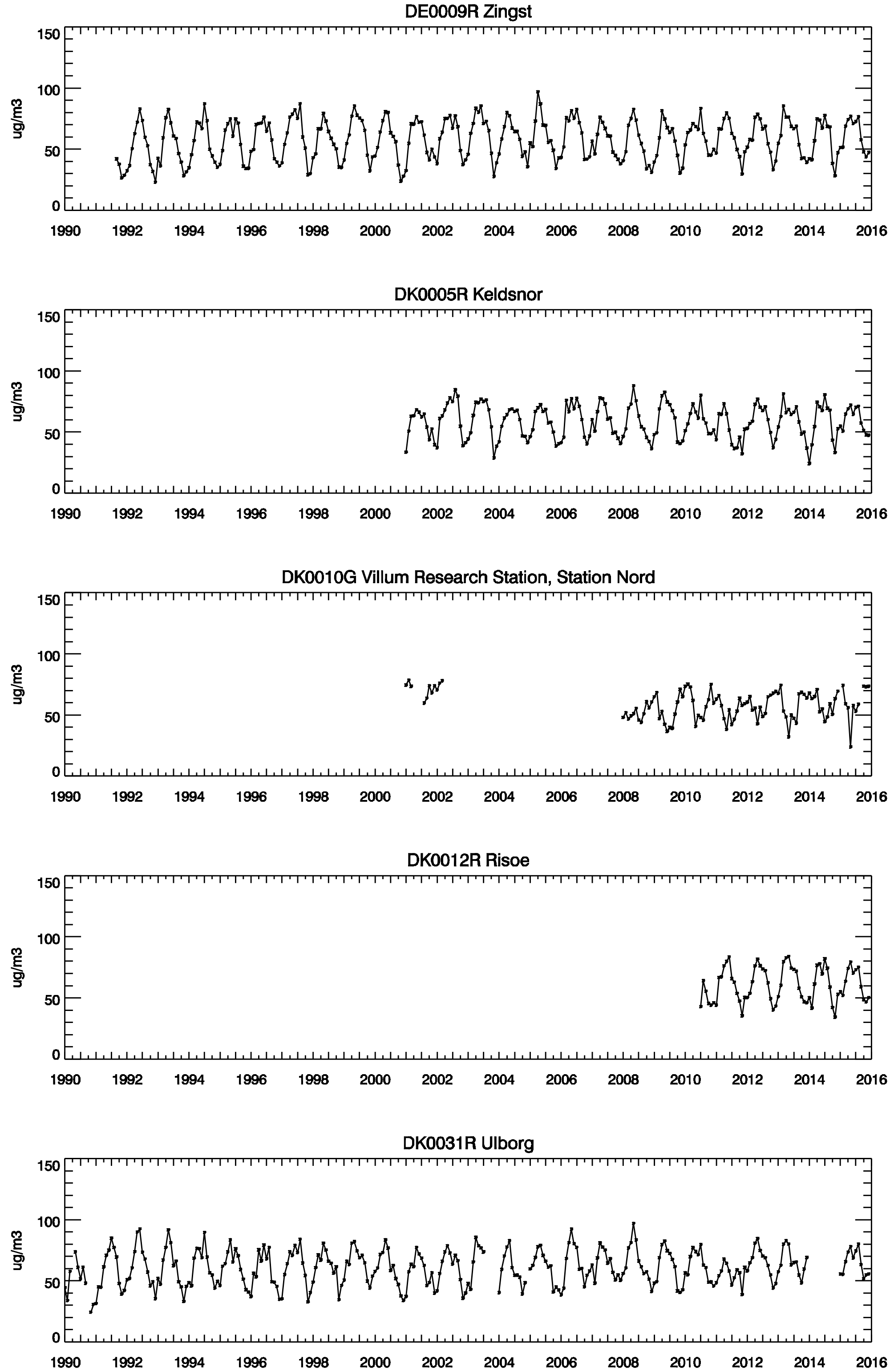


Figure 3.1, cont.

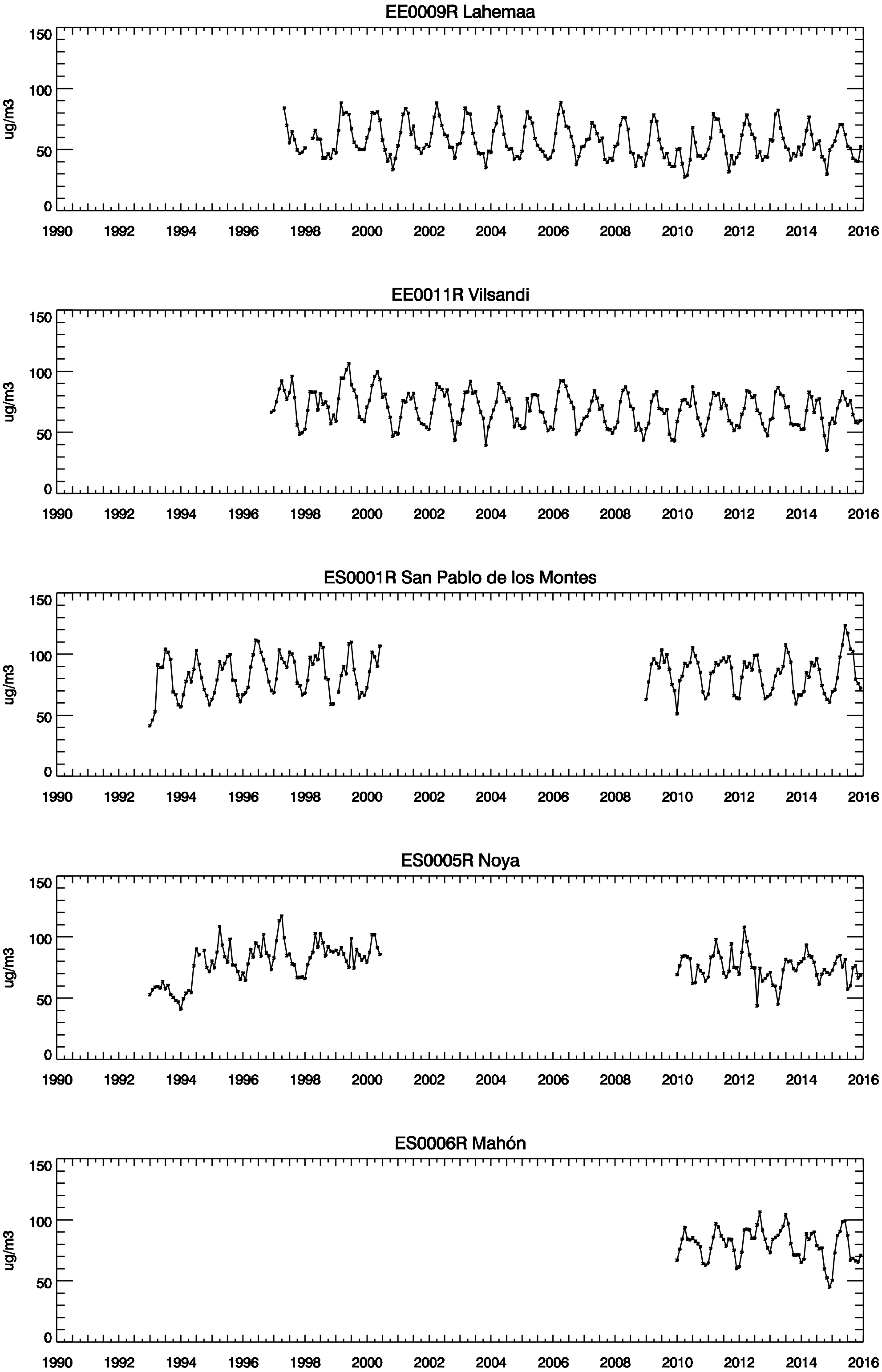


Figure 3.1, cont.

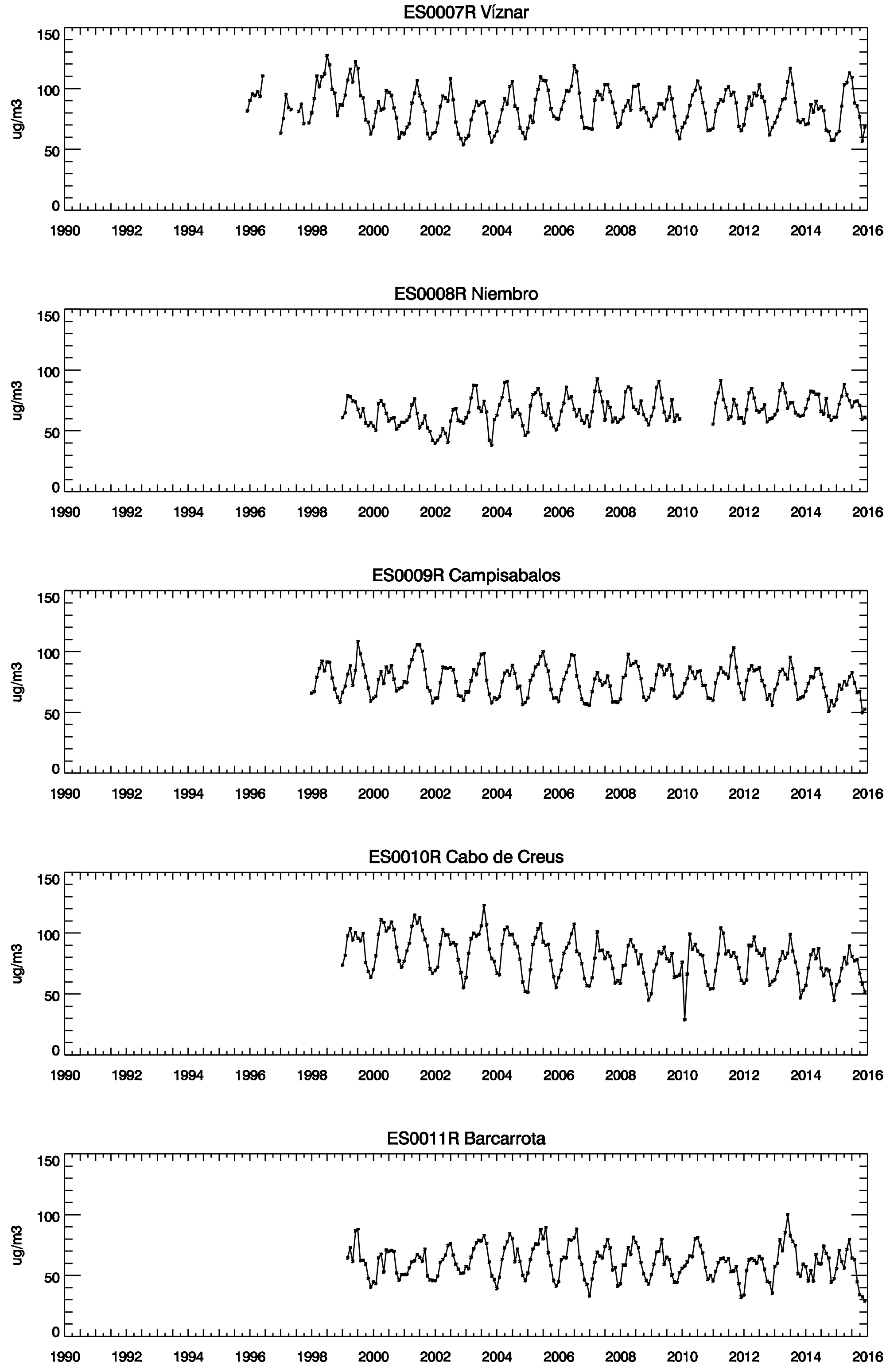


Figure 3.1, cont.

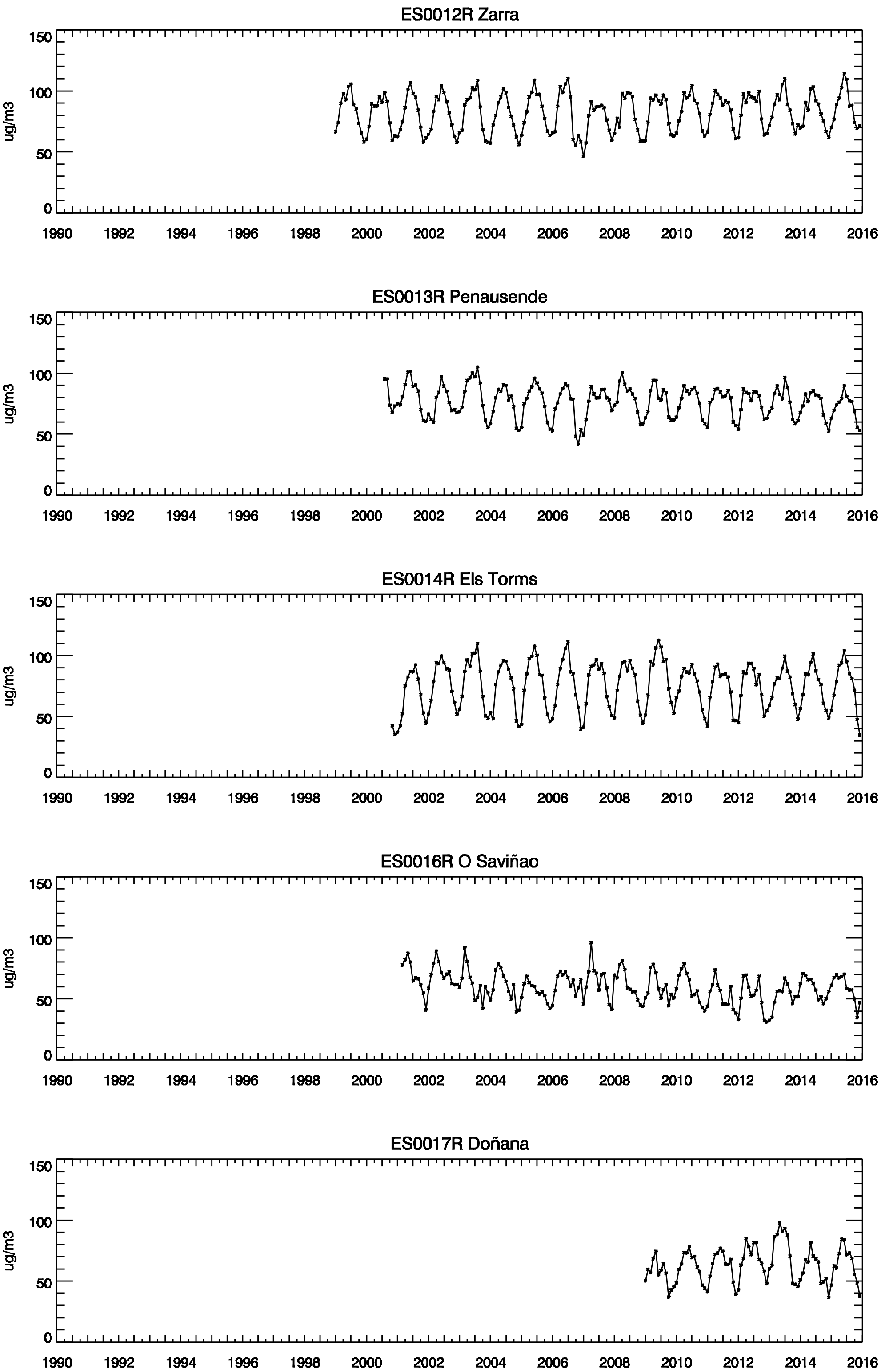


Figure 3.1, cont.

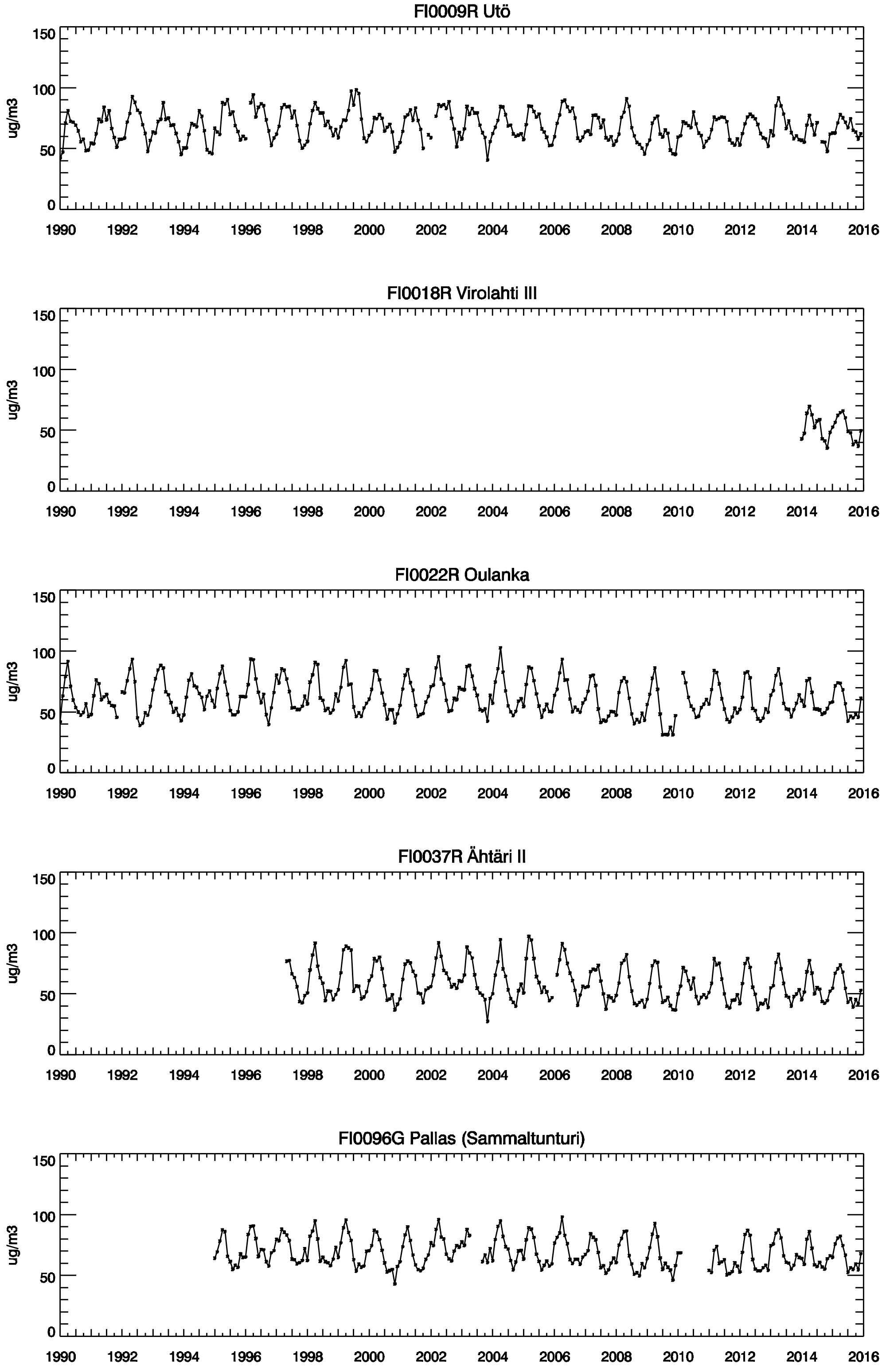


Figure 3.1, cont.

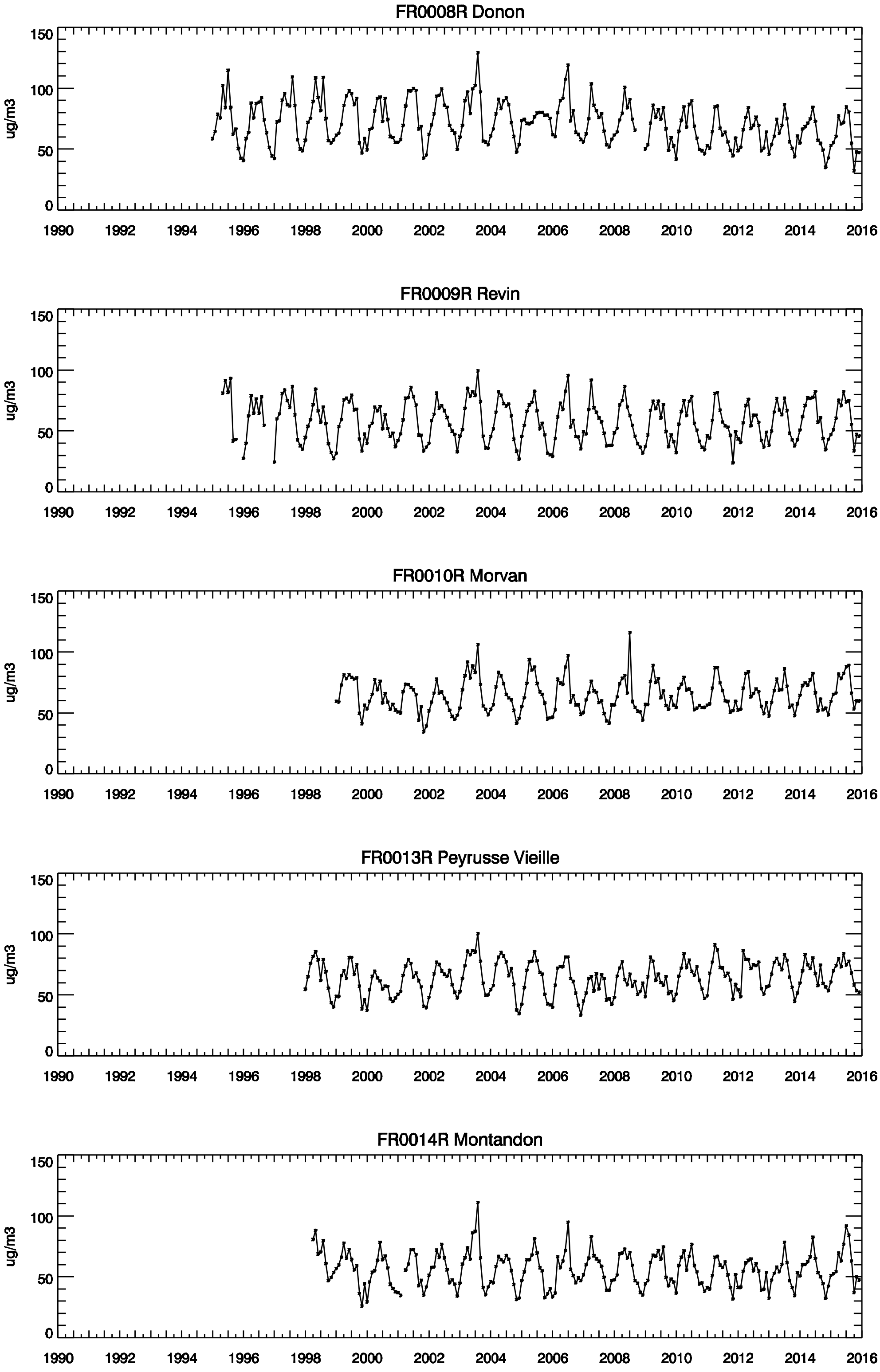


Figure 3.1, cont.

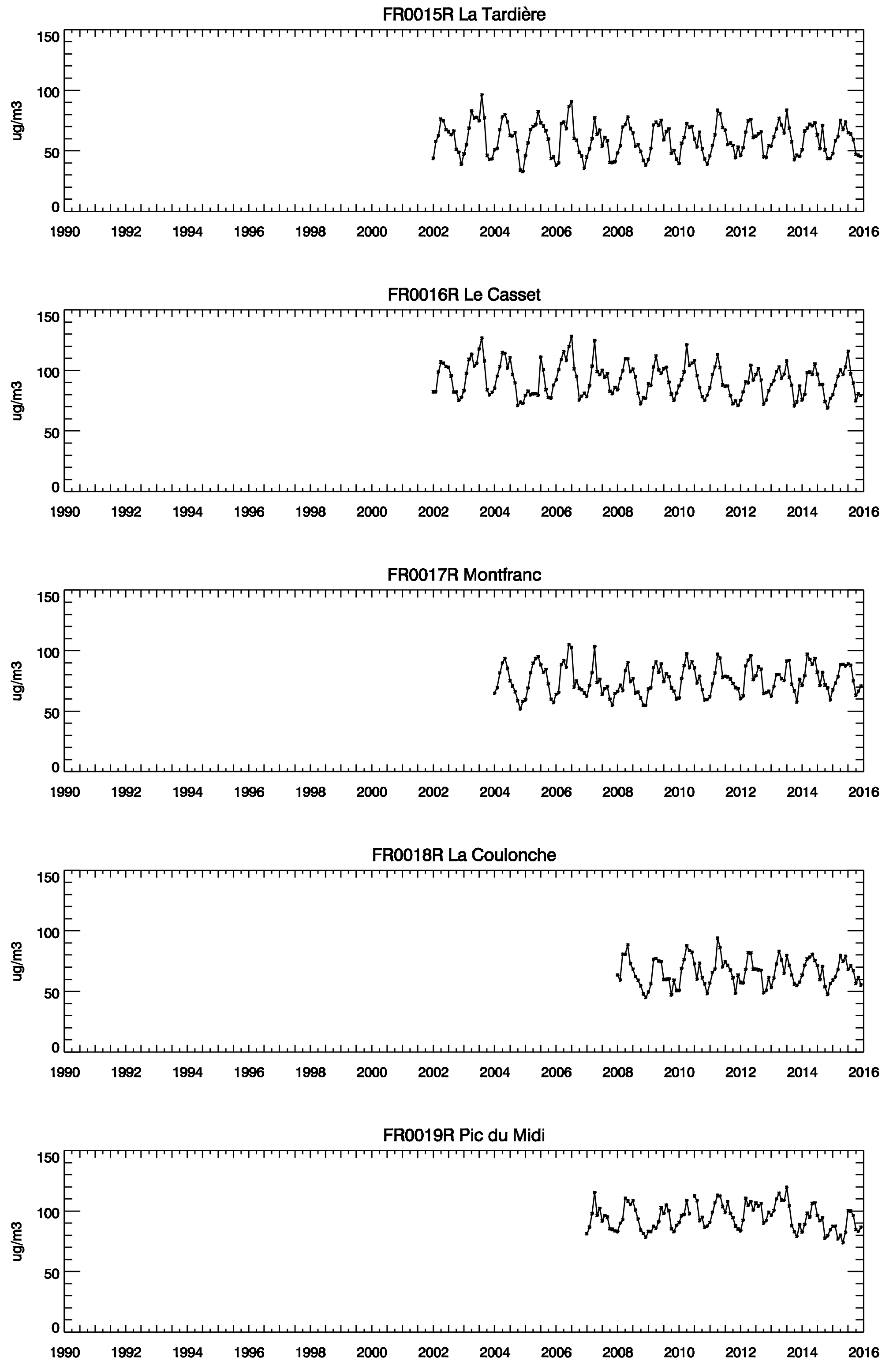


Figure 3.1, cont.

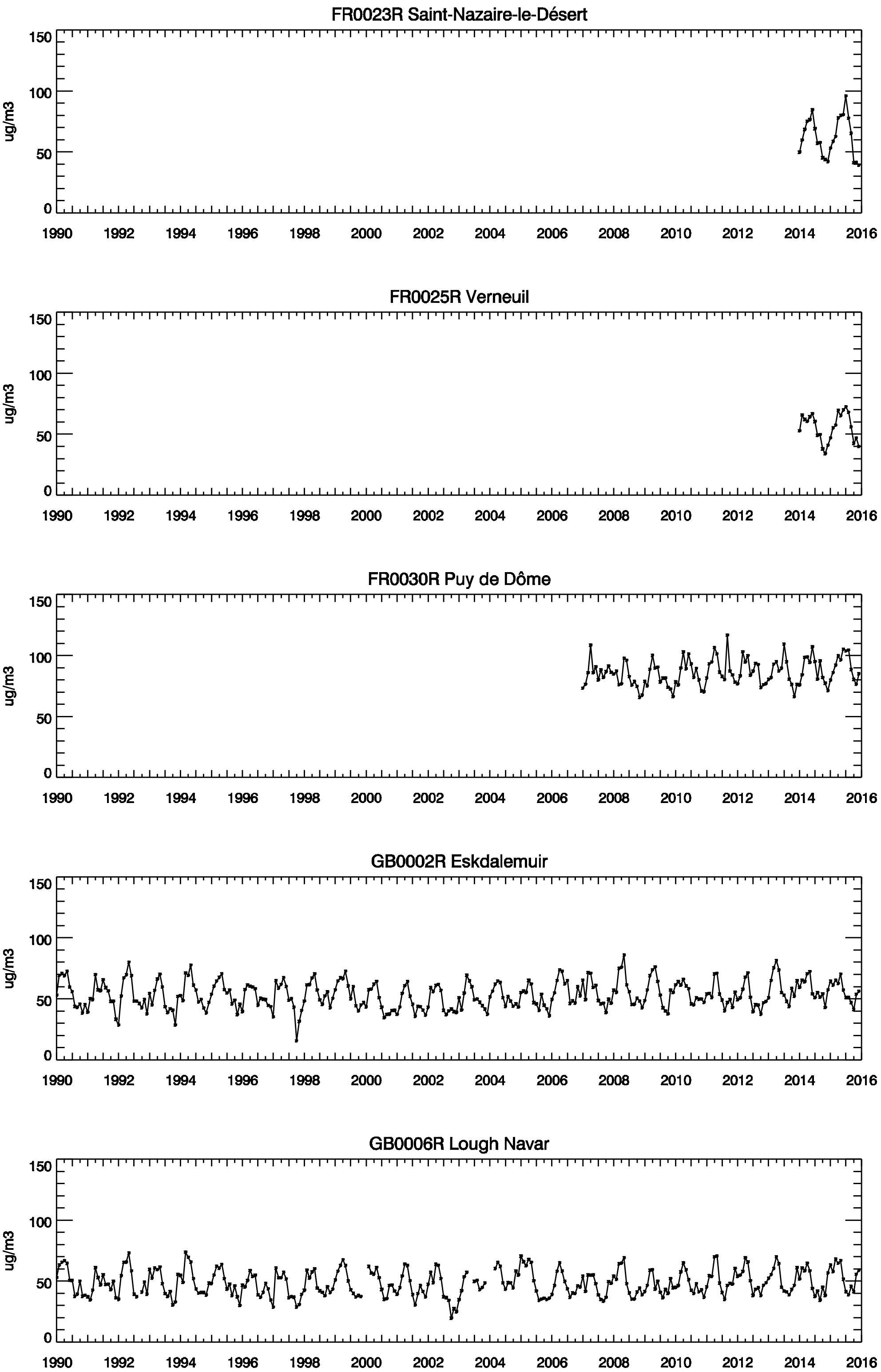


Figure 3.1, cont.

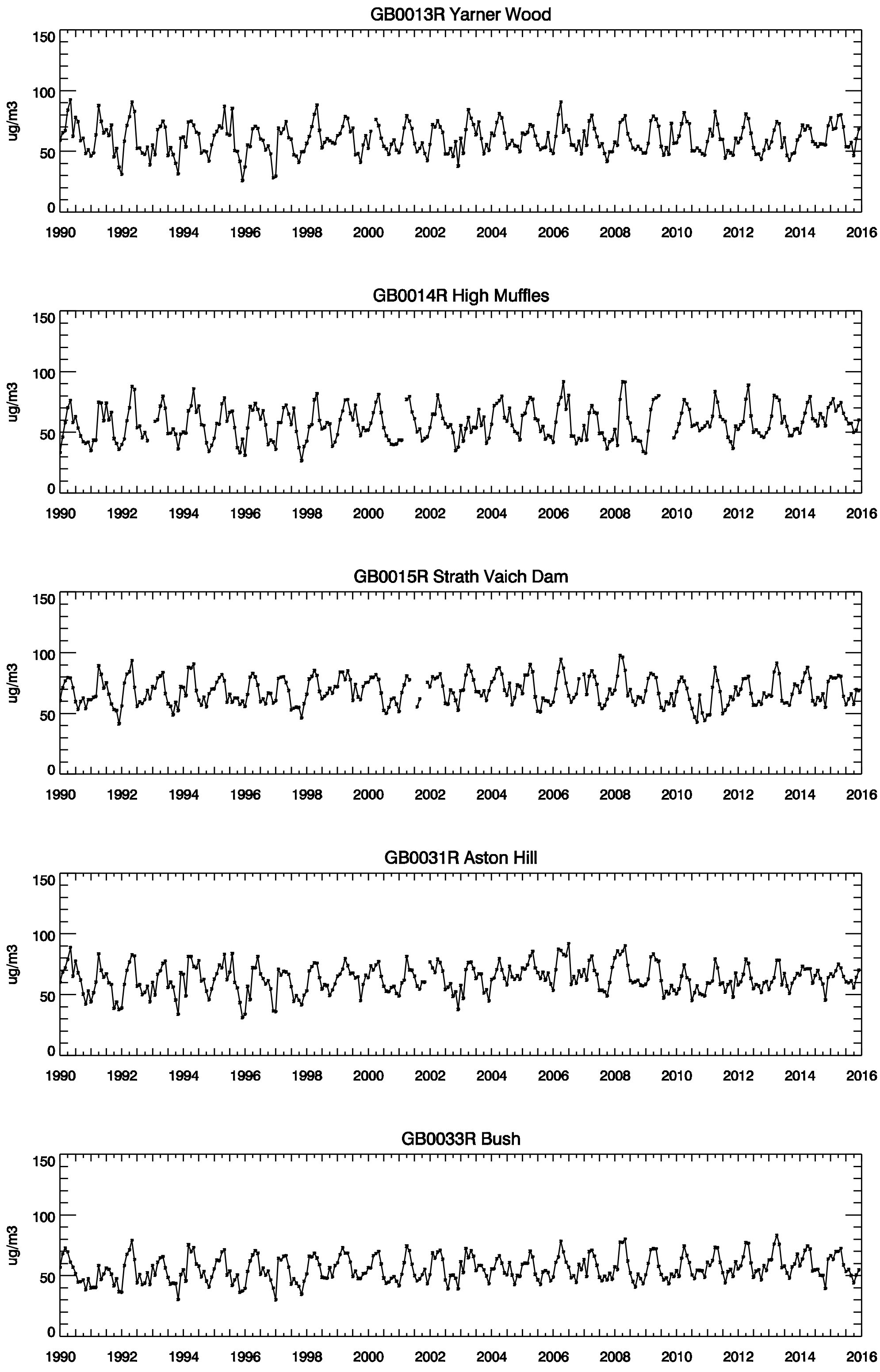


Figure 3.1, cont.

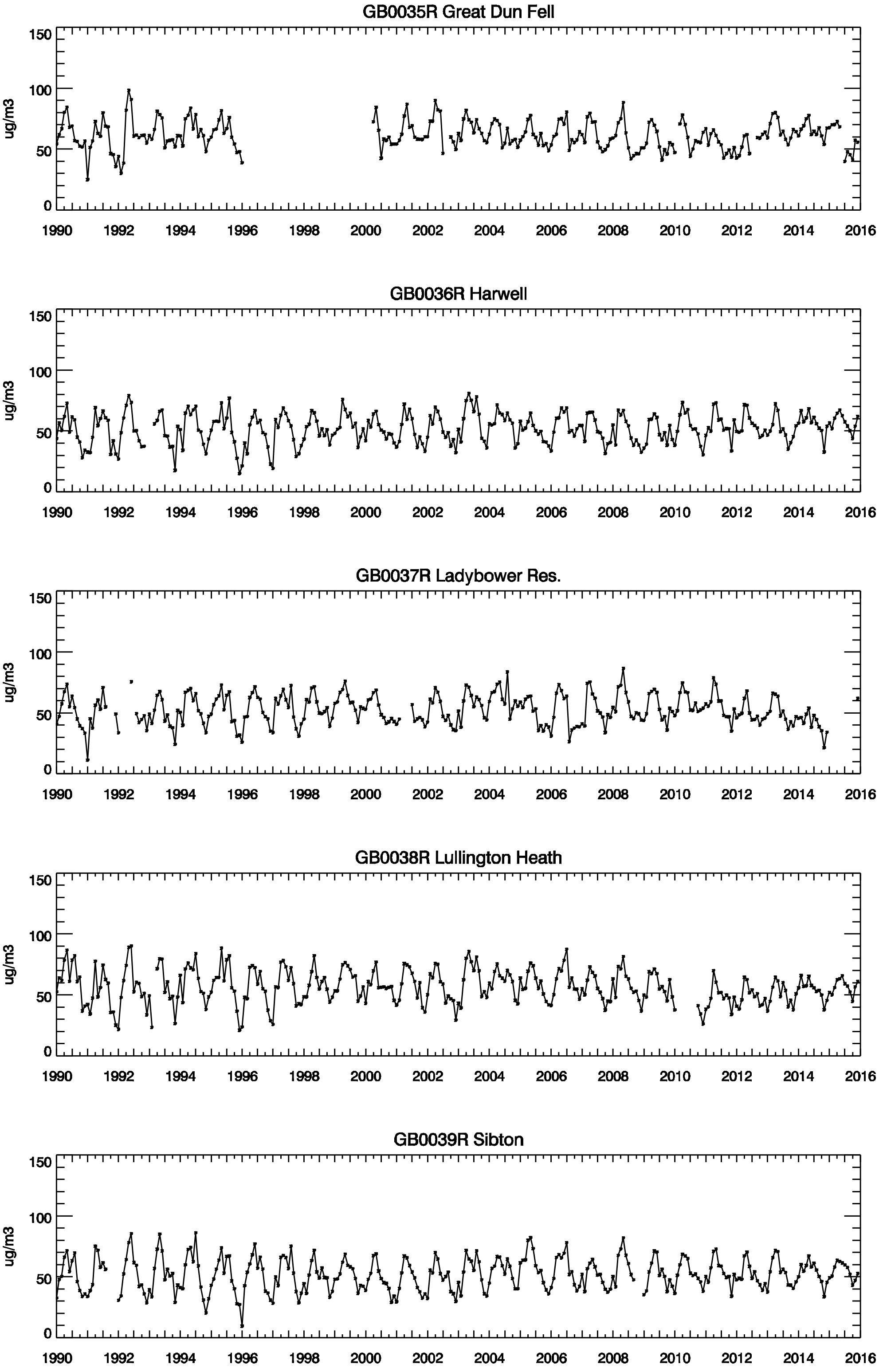


Figure 3.1, cont.

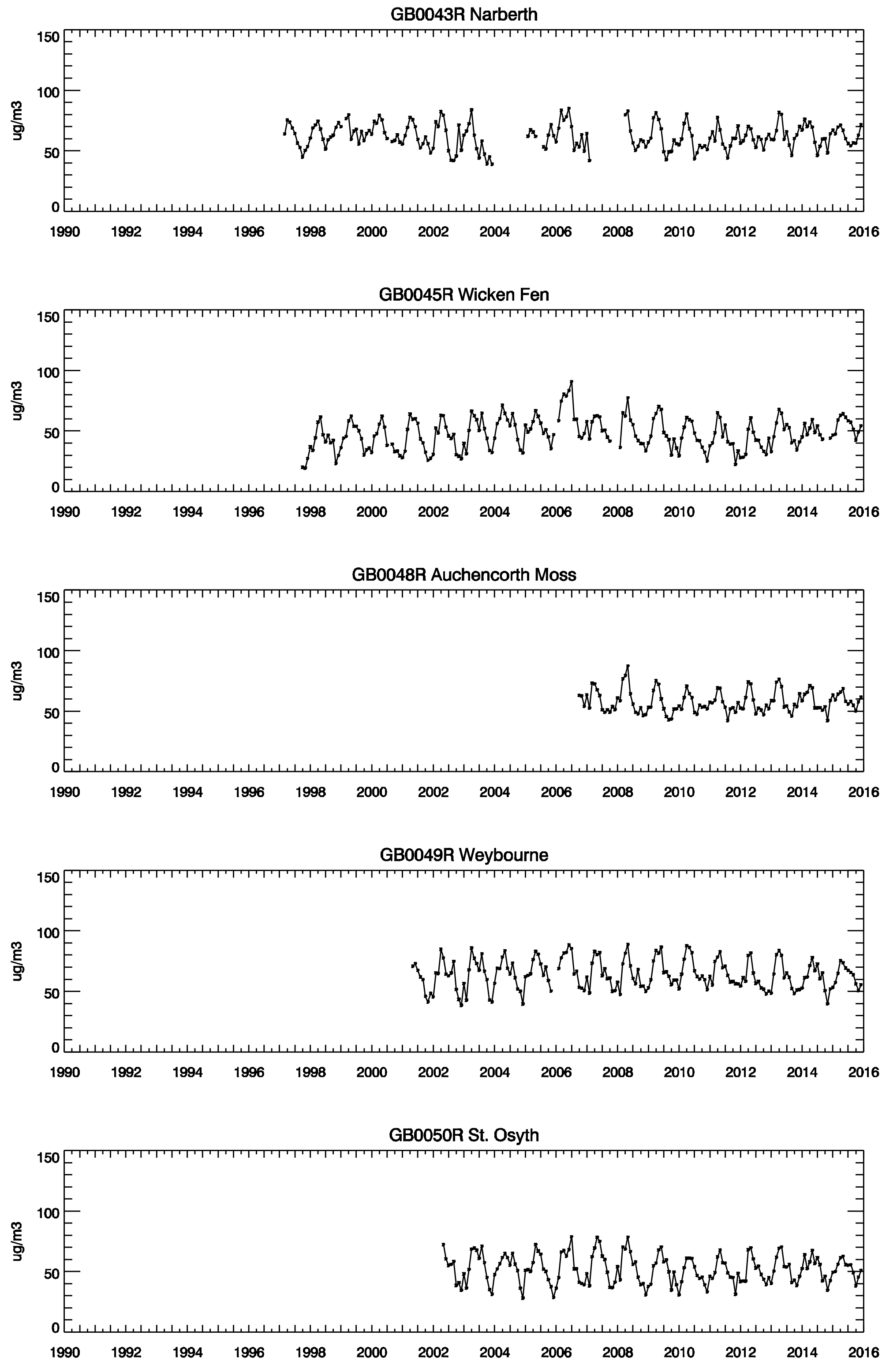


Figure 3.1, cont.

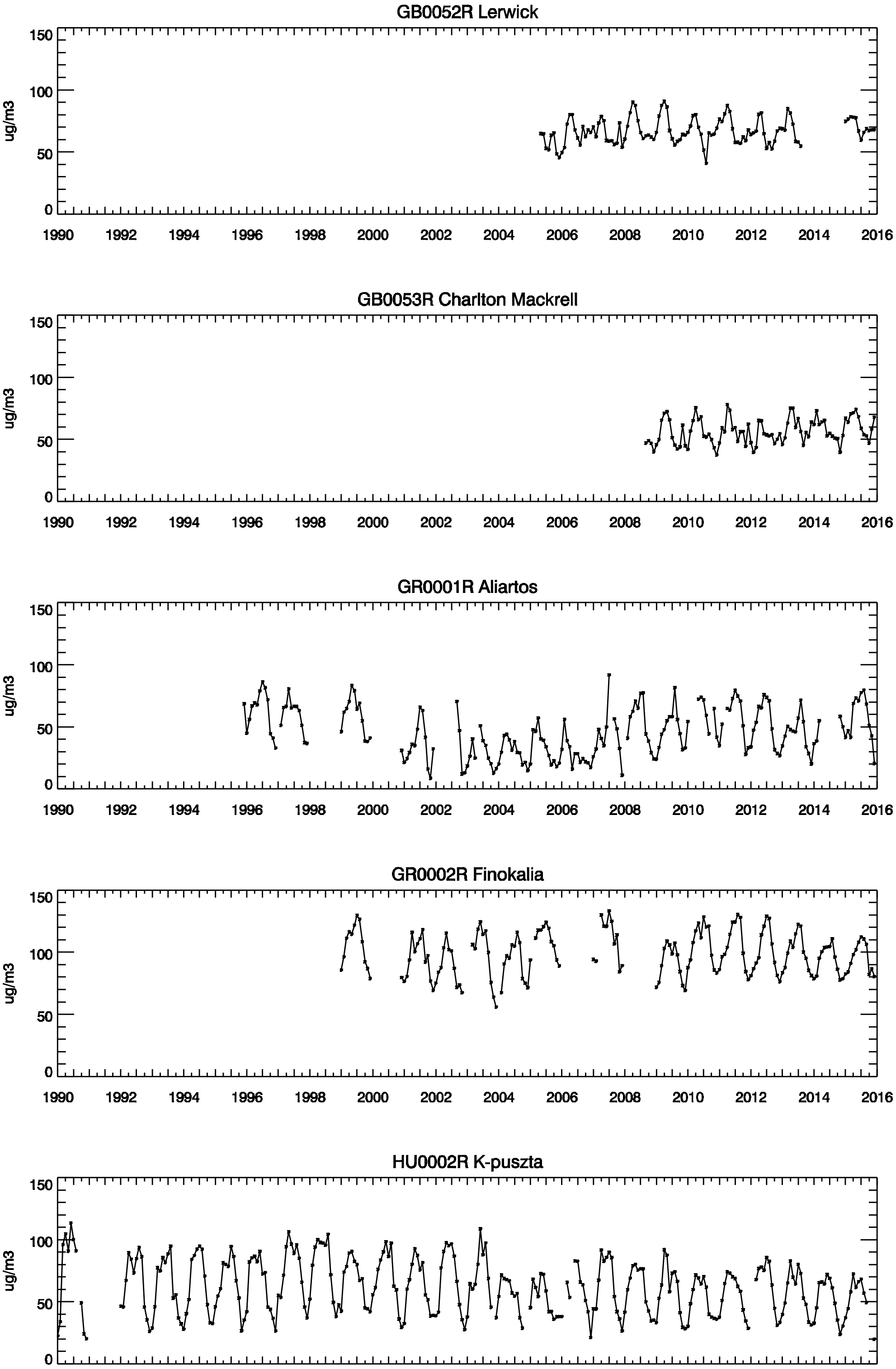


Figure 3.1, cont.

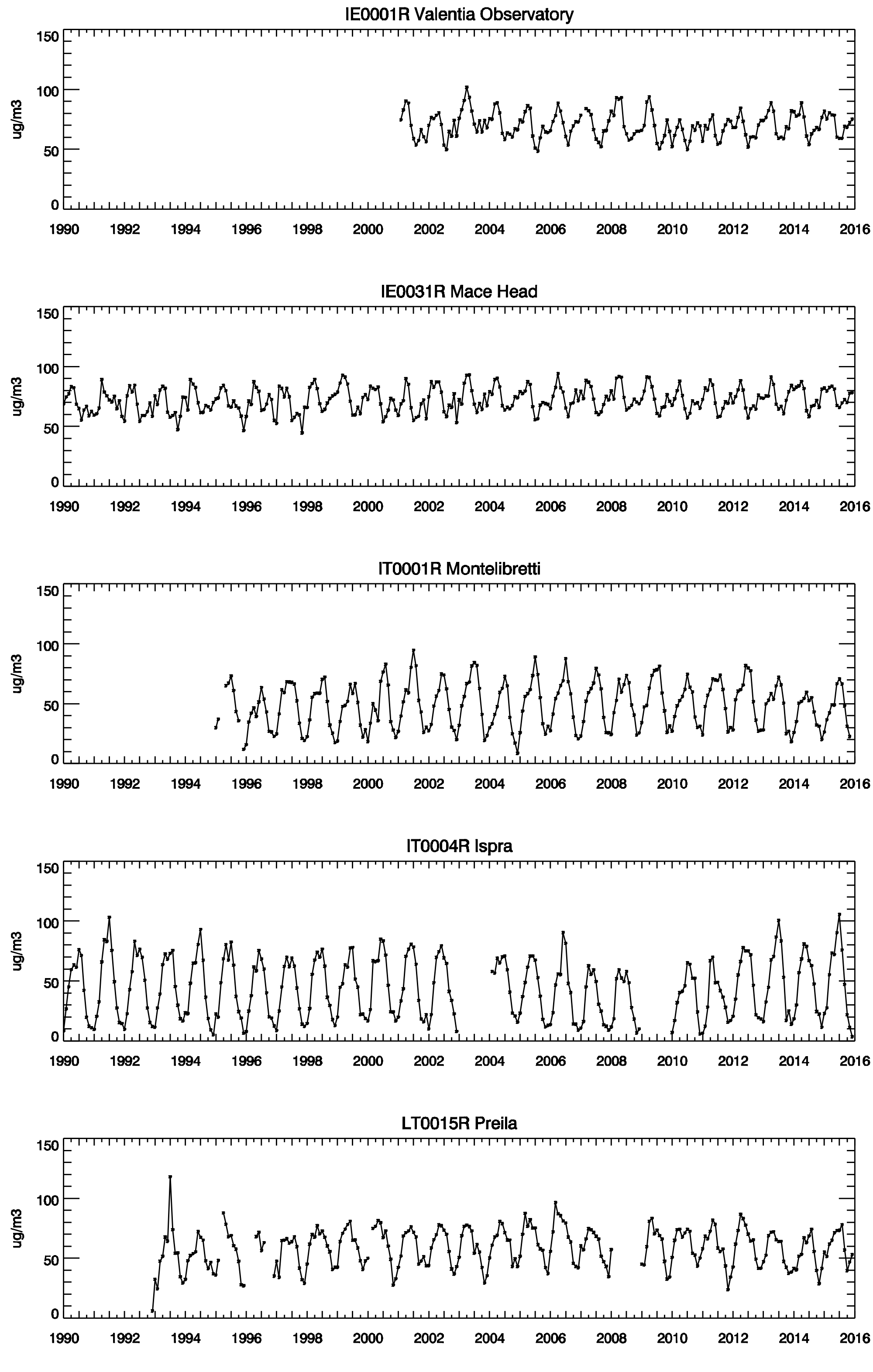


Figure 3.1, cont.

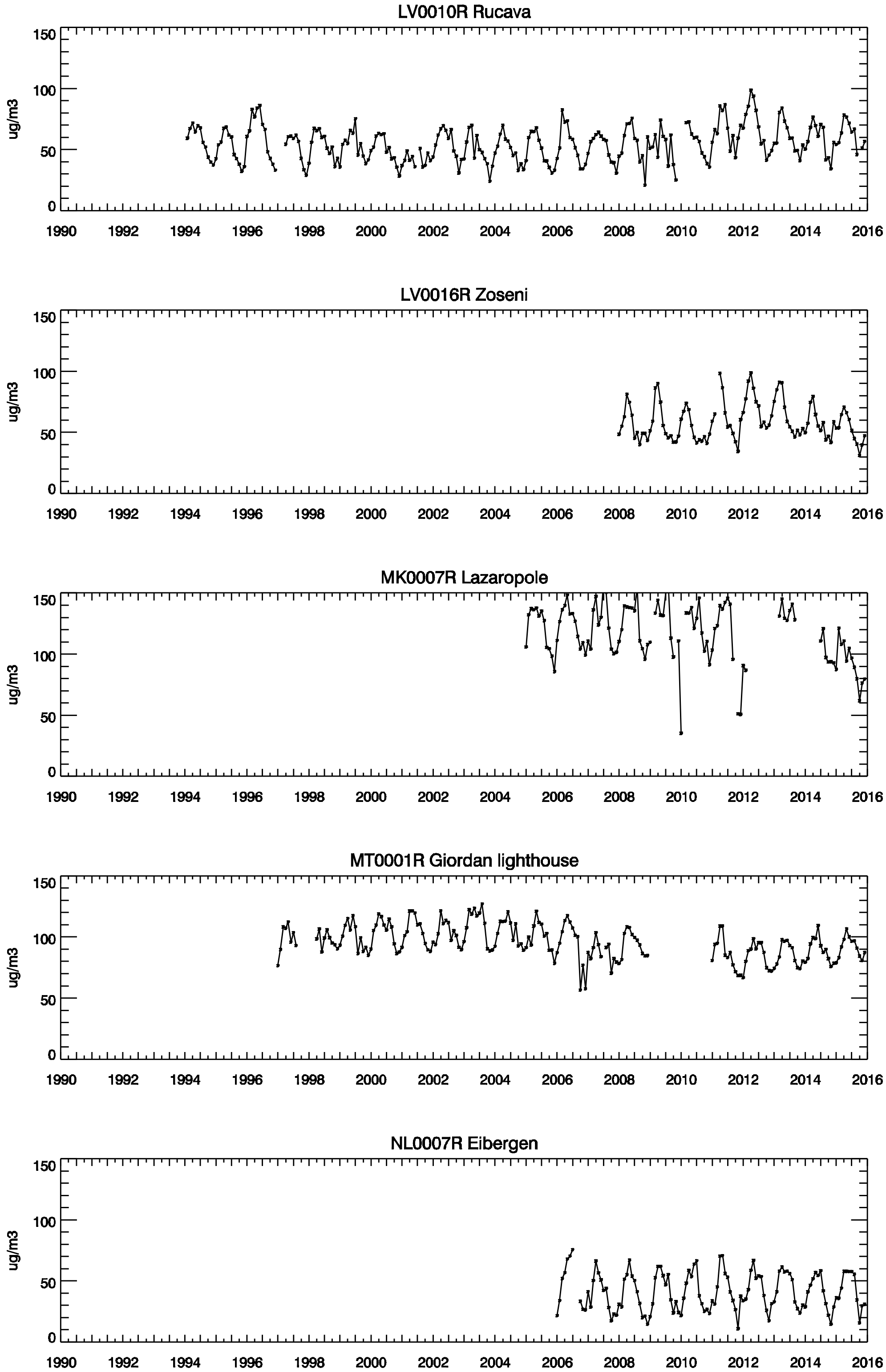


Figure 3.1, cont.

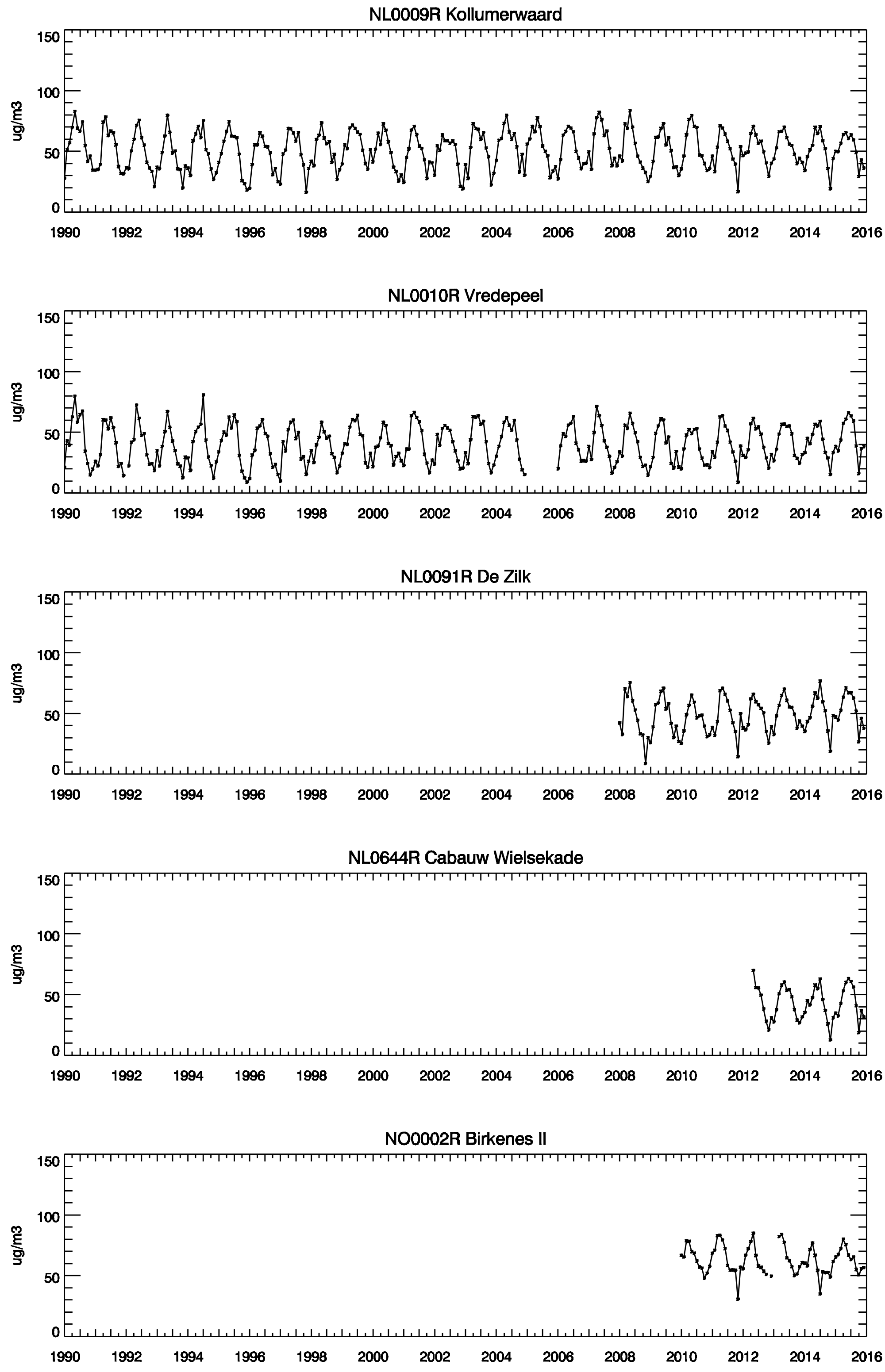


Figure 3.1, cont.

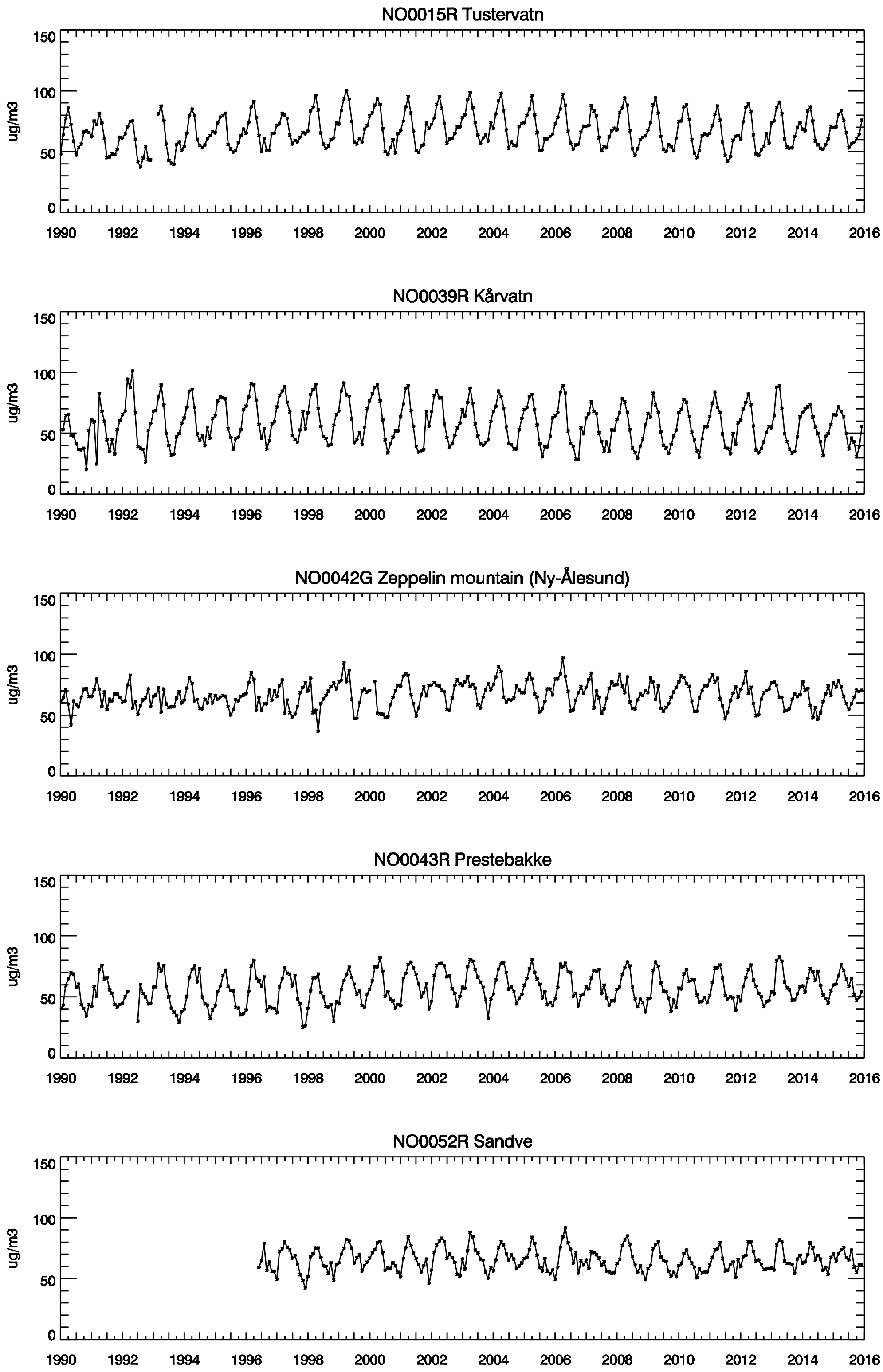


Figure 3.1, cont.

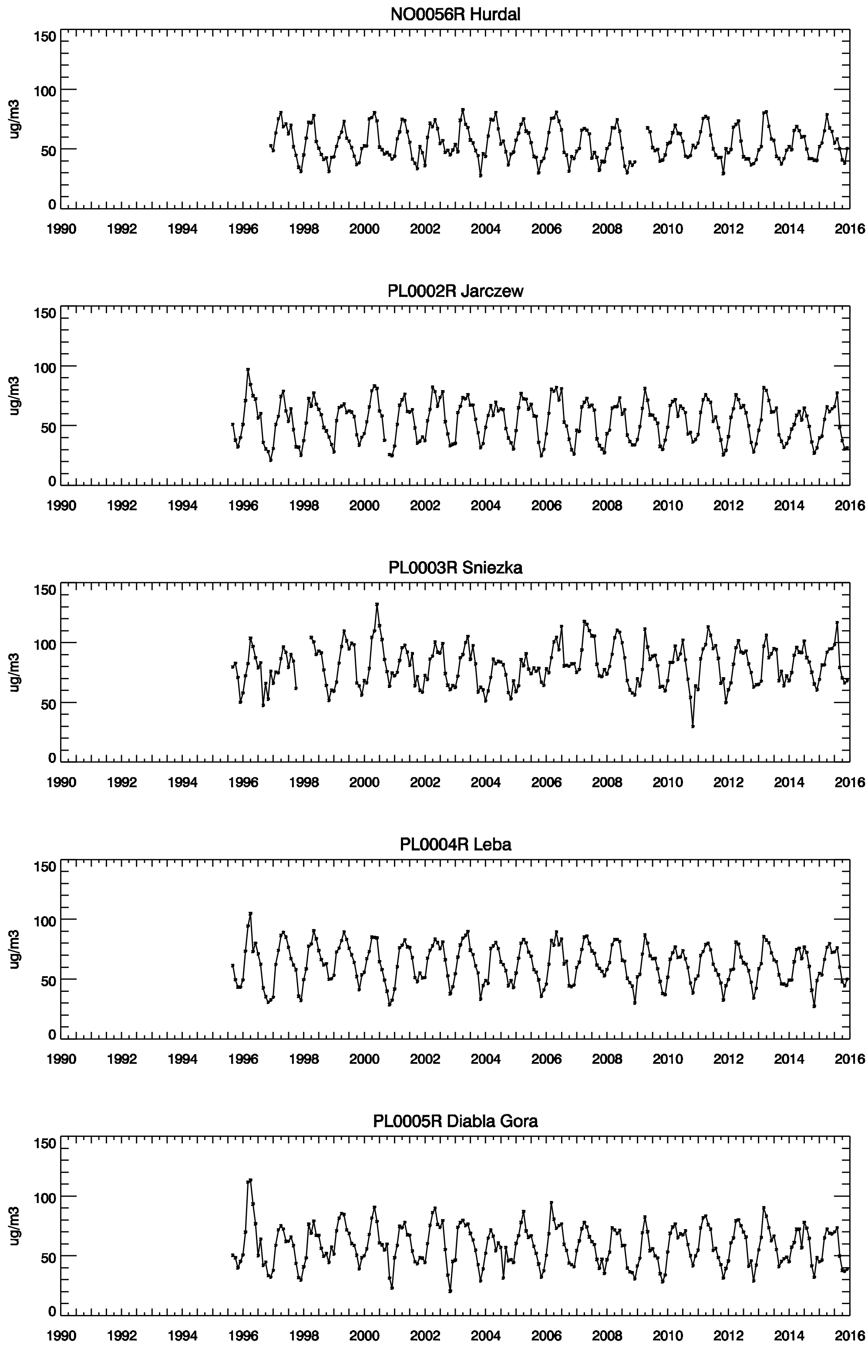


Figure 3.1, cont.

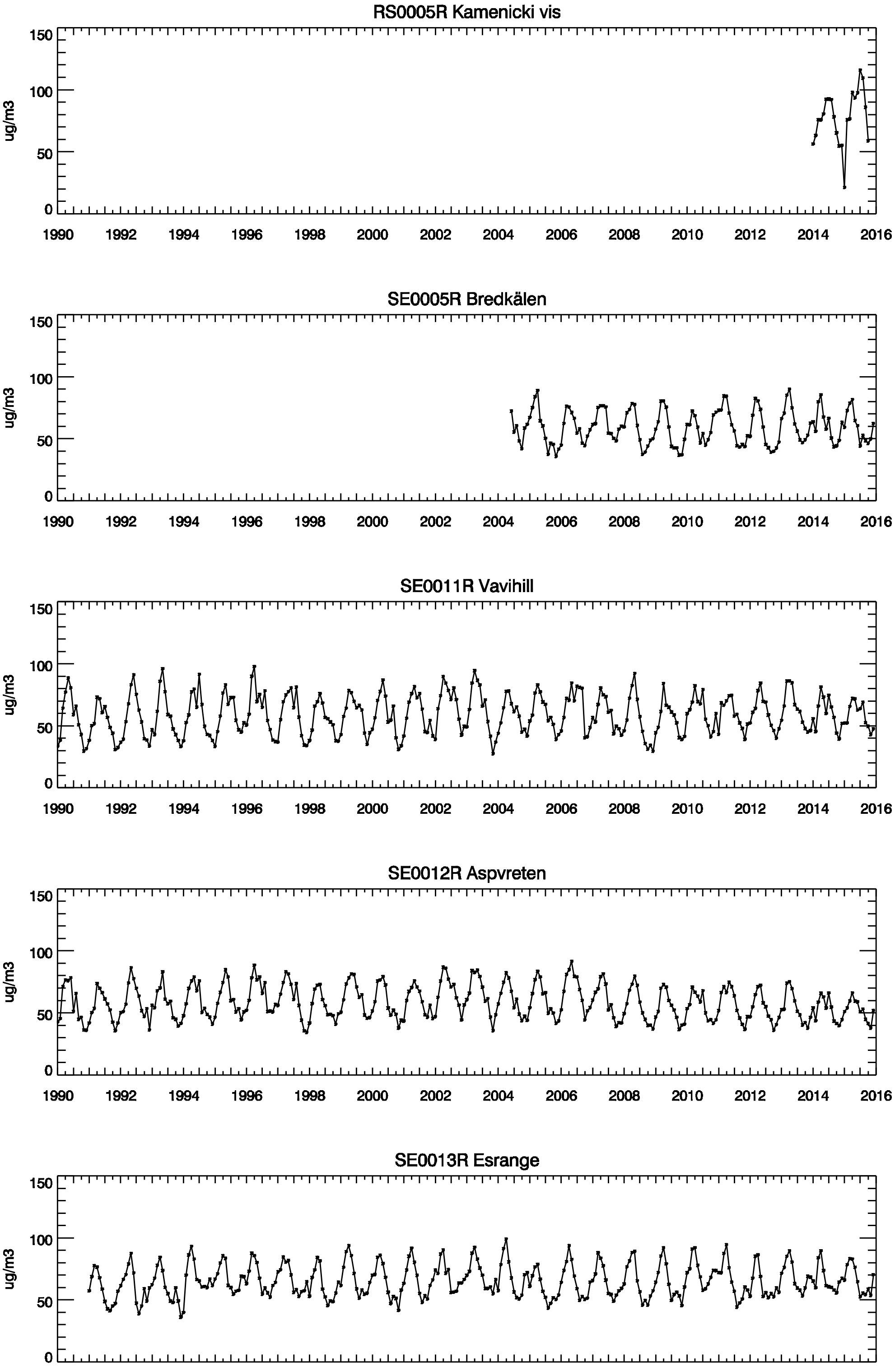
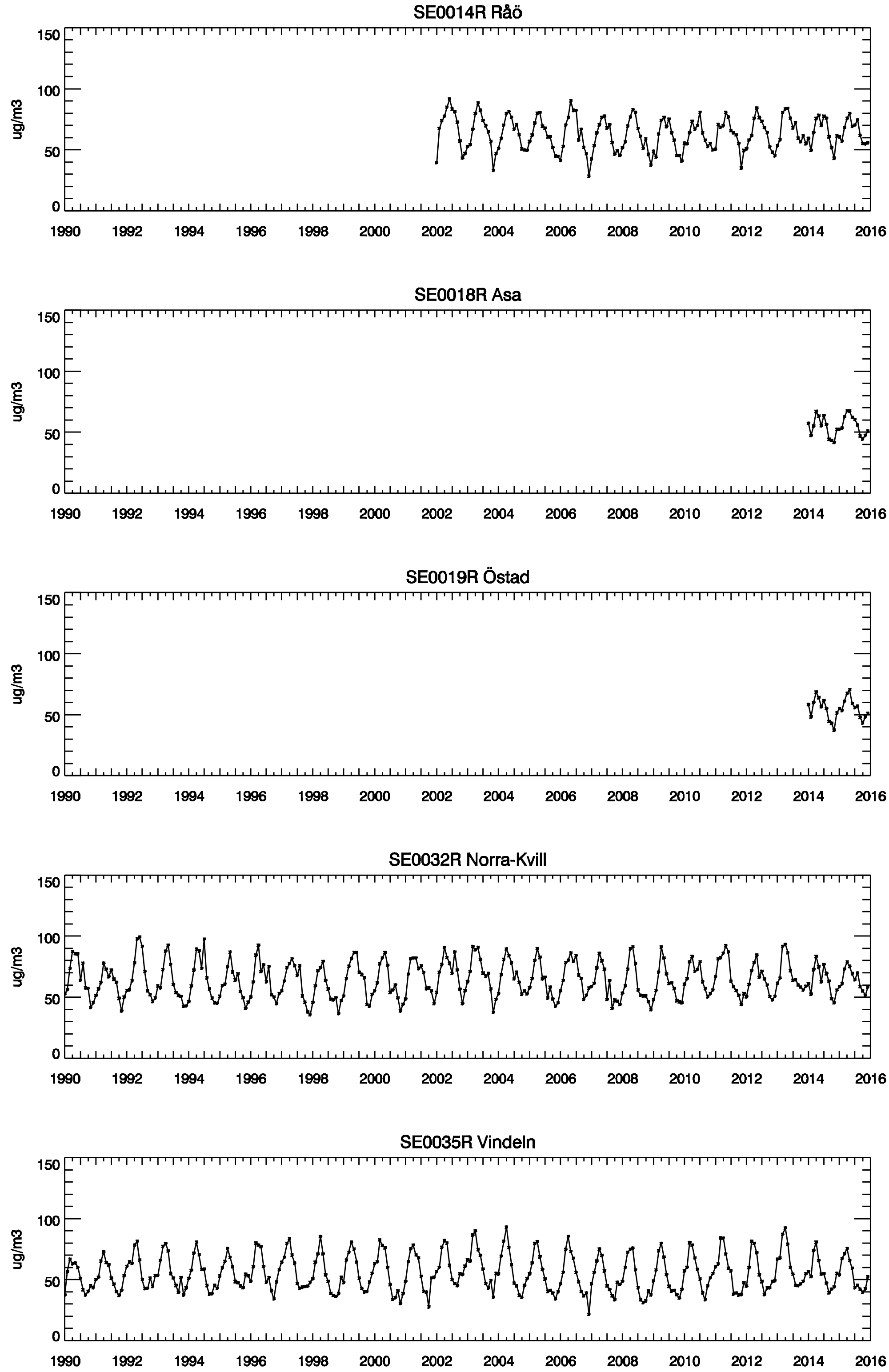


Figure 3.1, cont.



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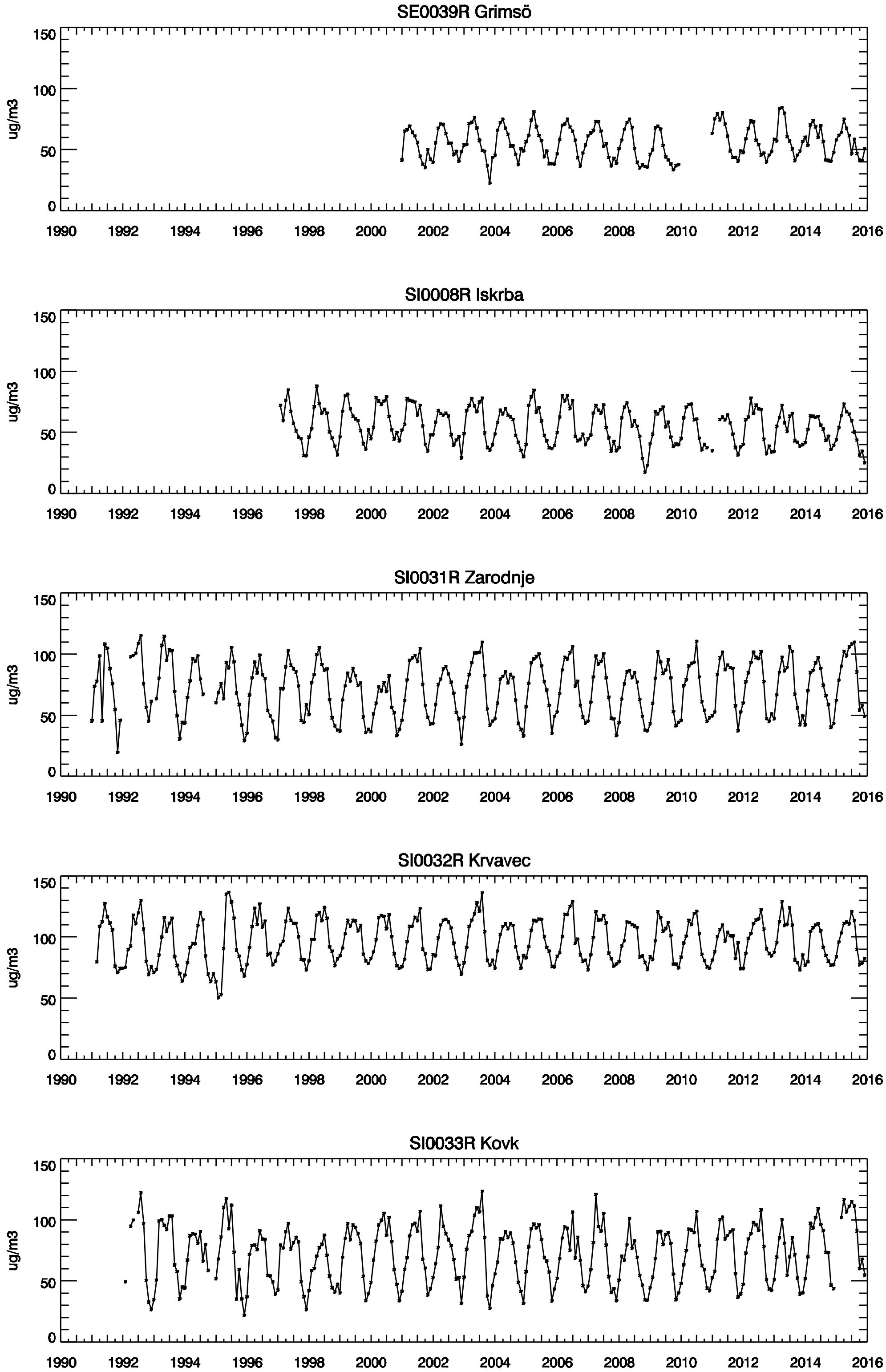


Figure 3.1, cont.

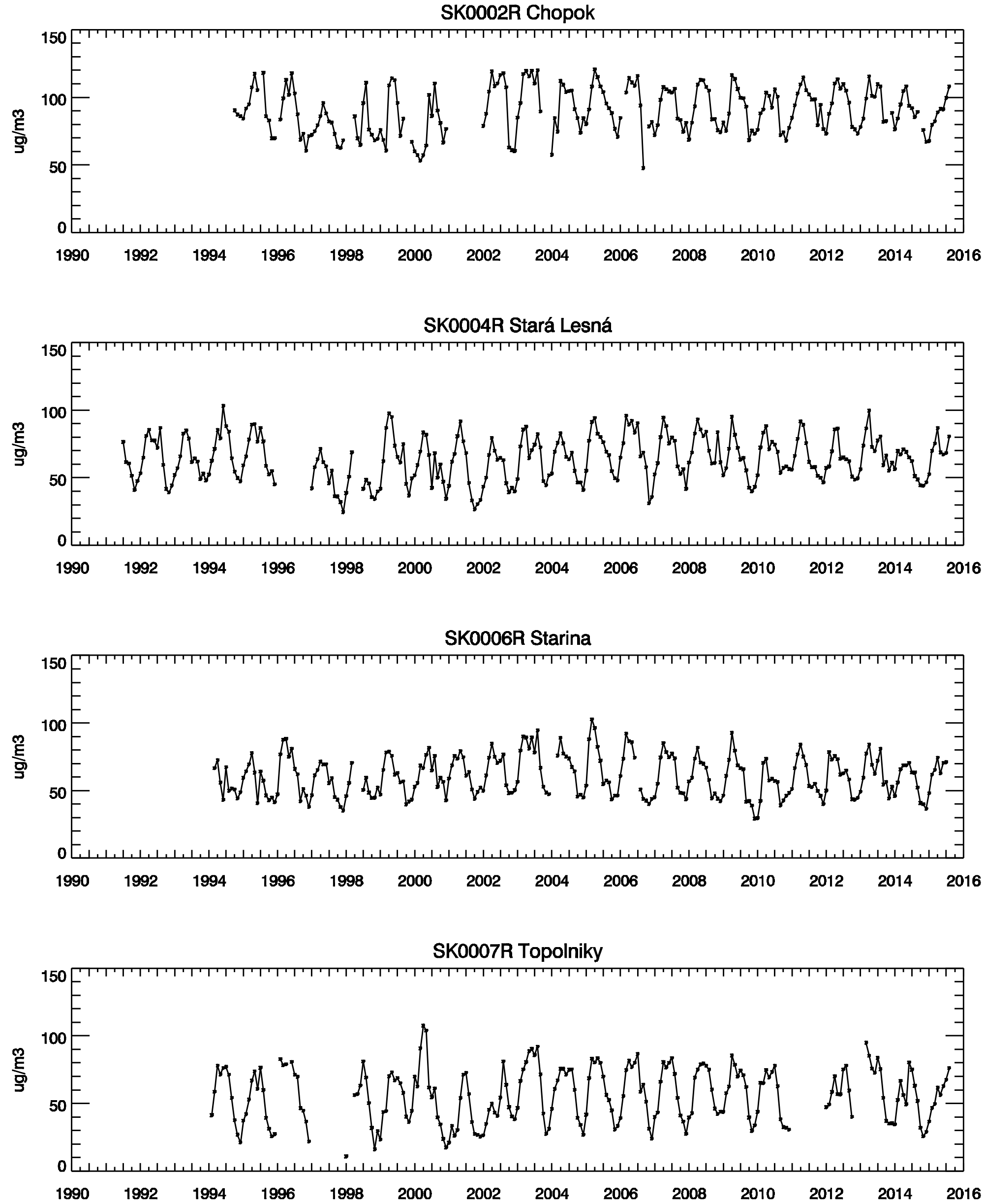


Figure 3.1, cont.

Annex 4

Diurnal variation, April–September 2015

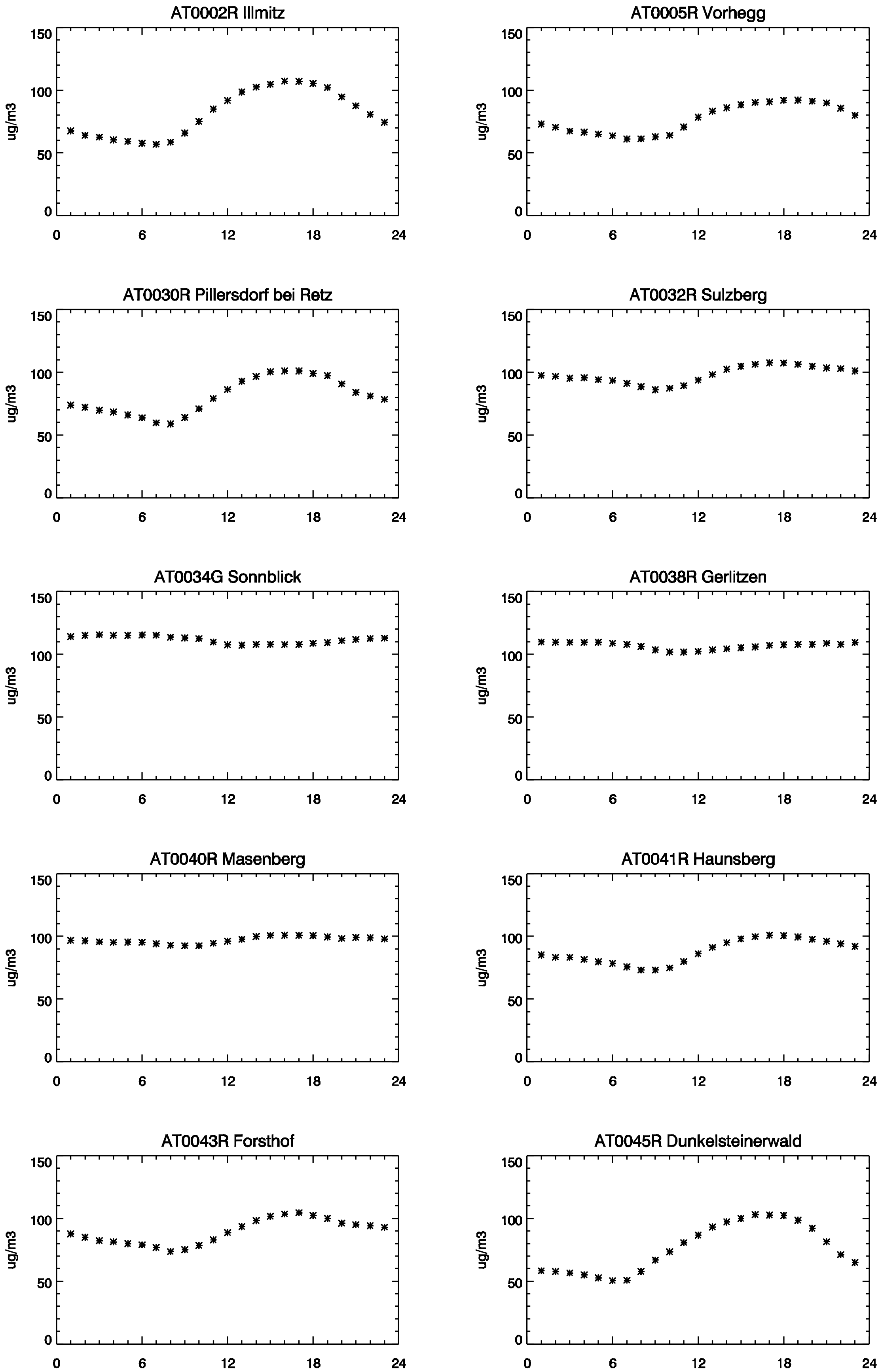


Figure 4.1: *Diurnal variation, April–September 2015.*

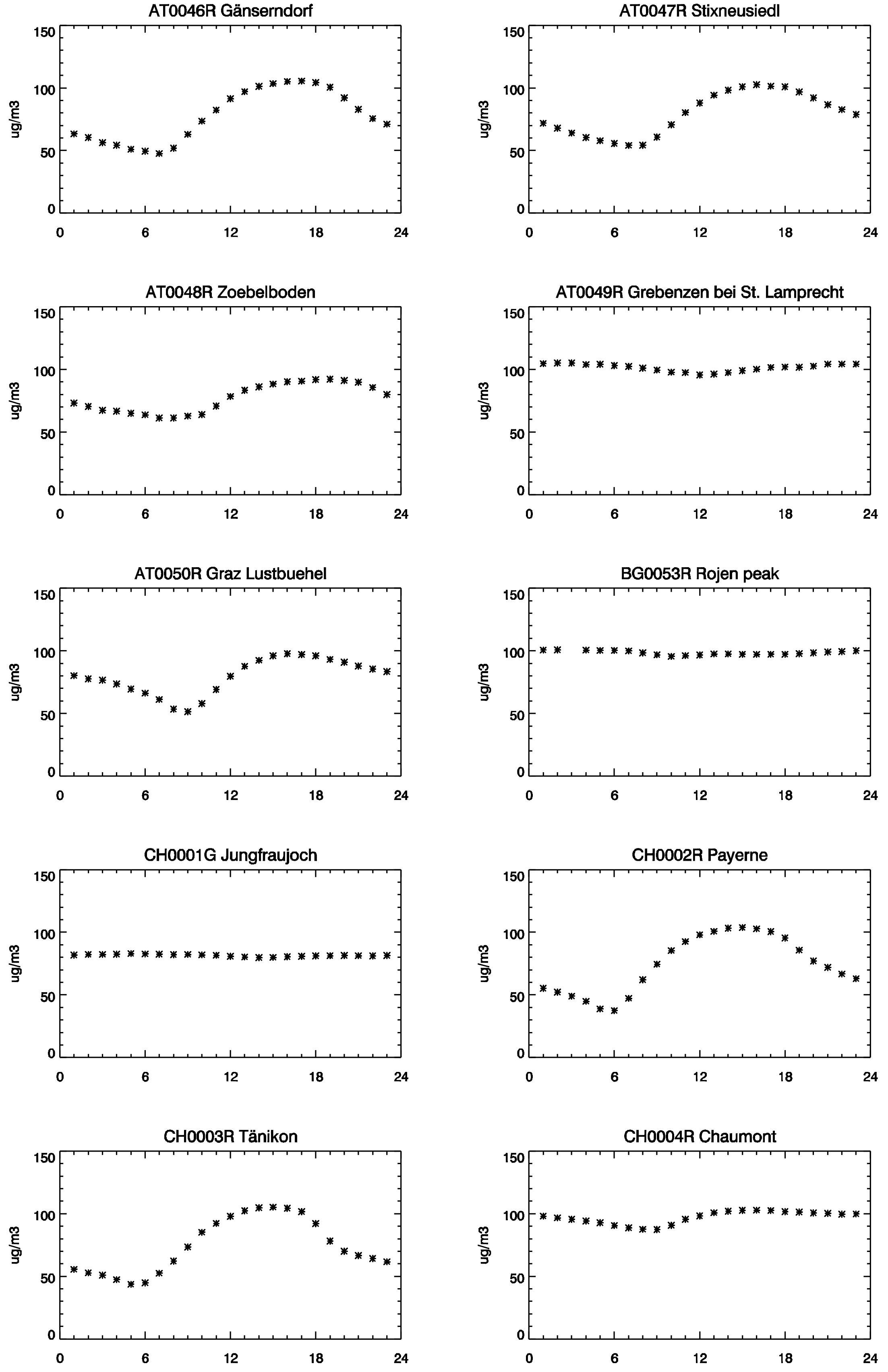
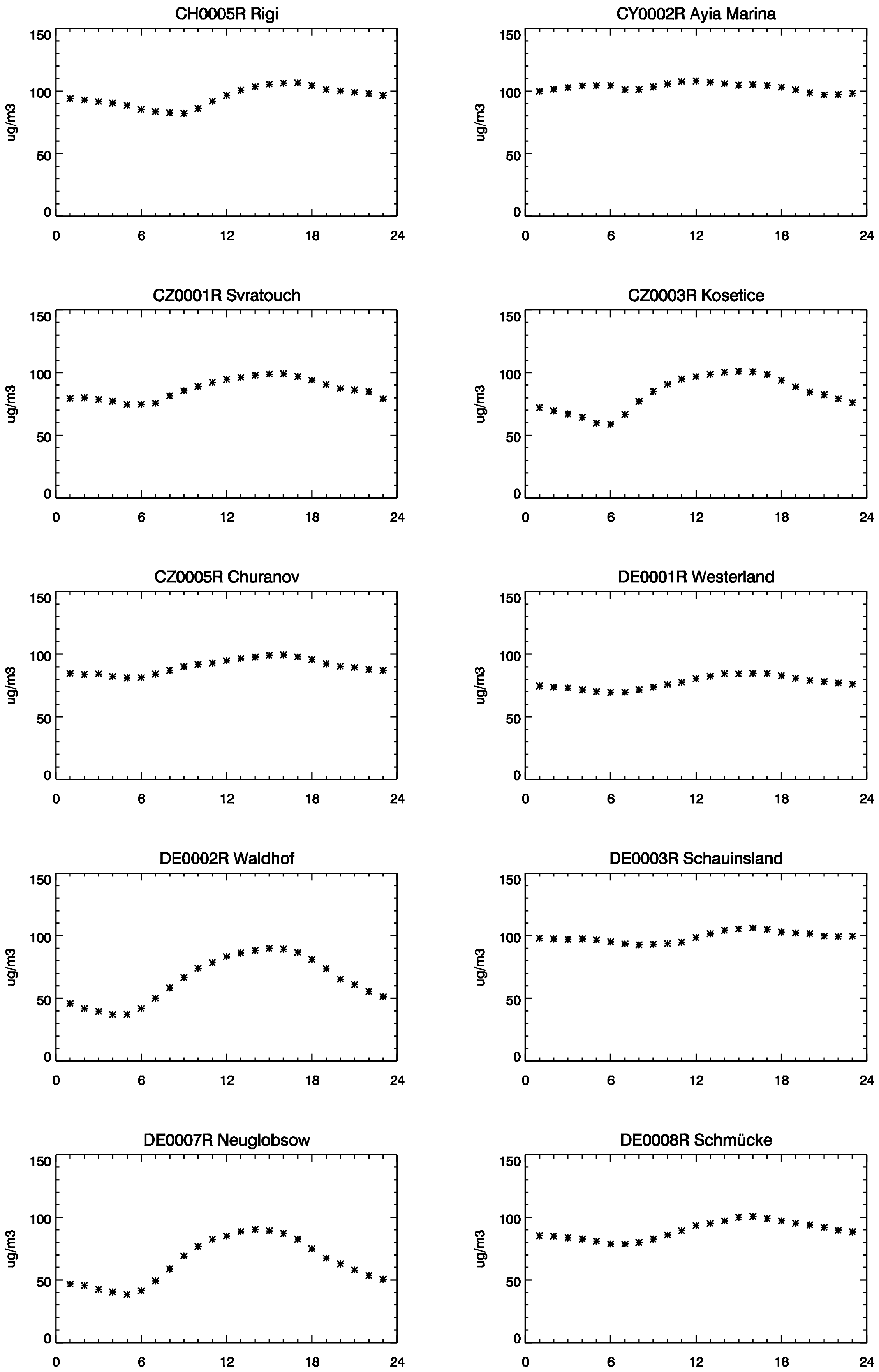


Figure 4.1, cont.



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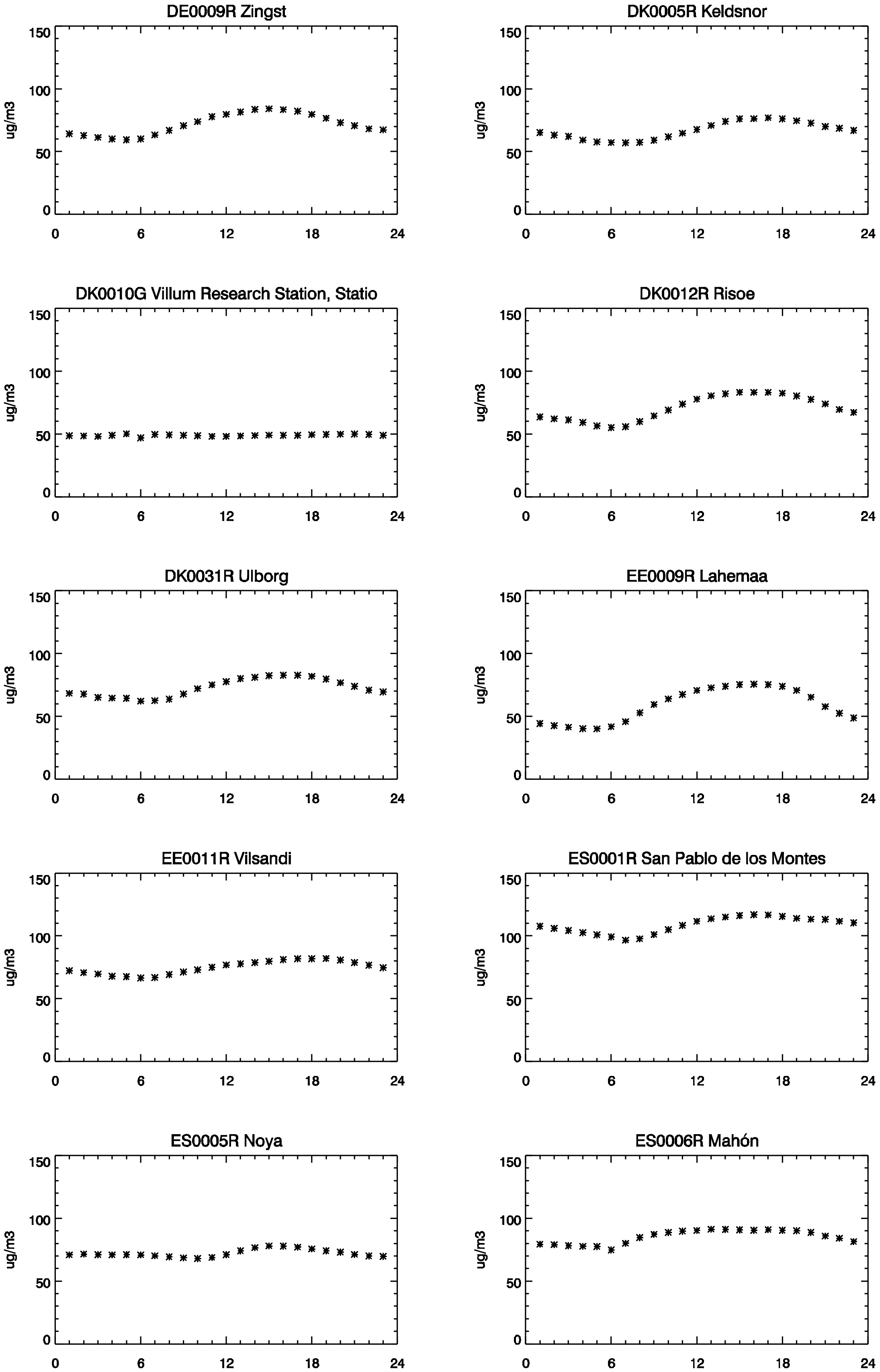

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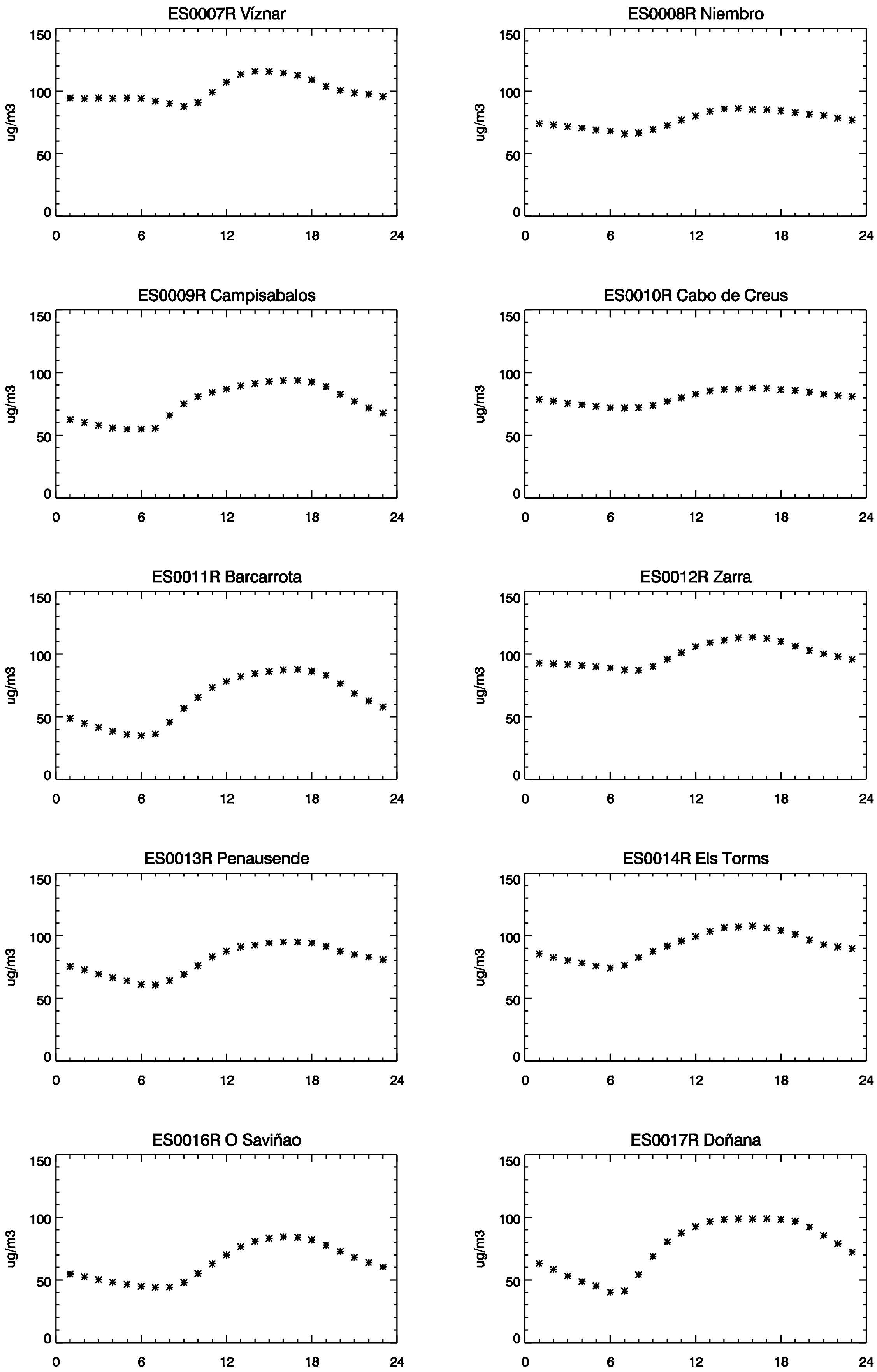

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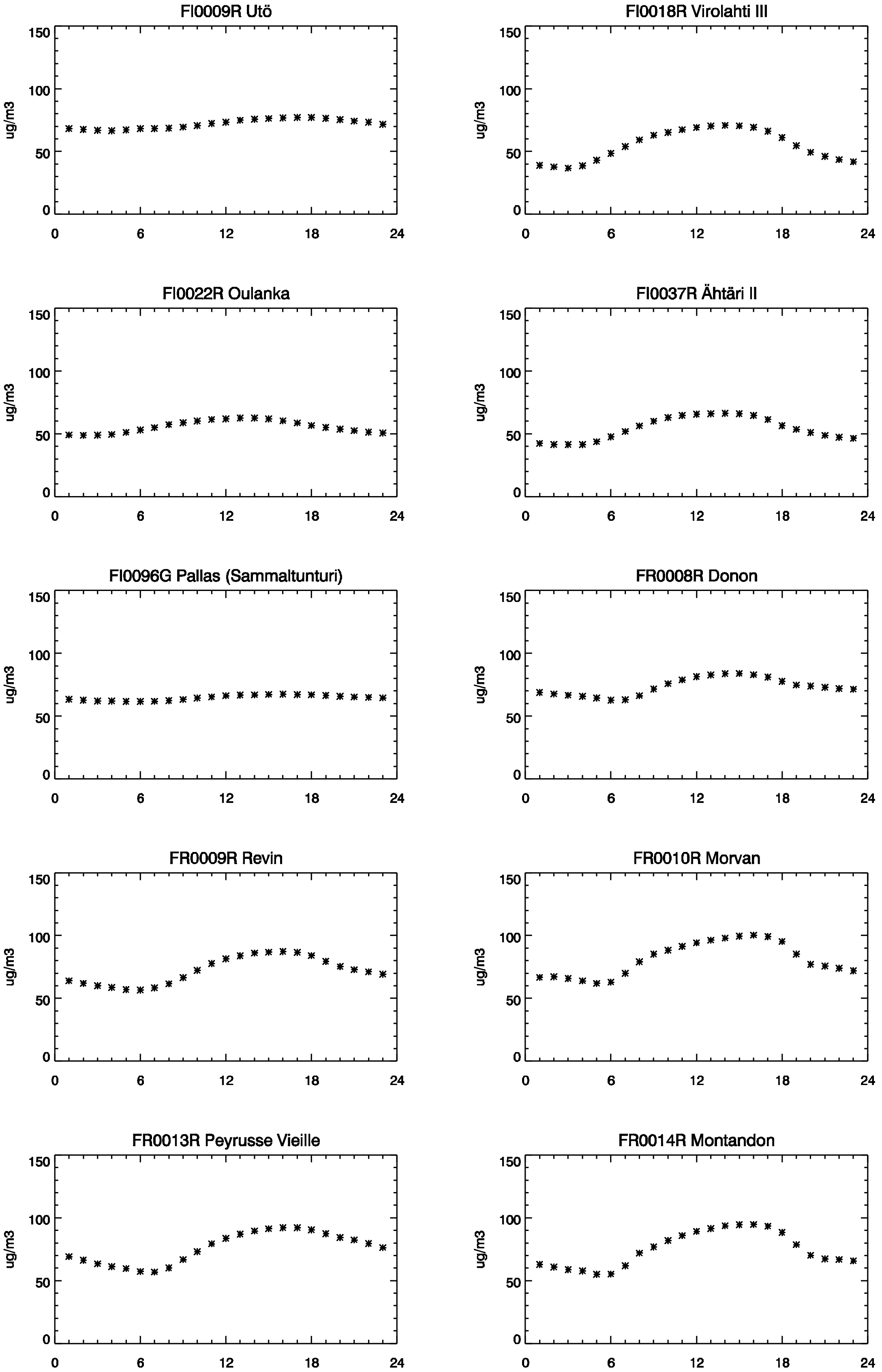

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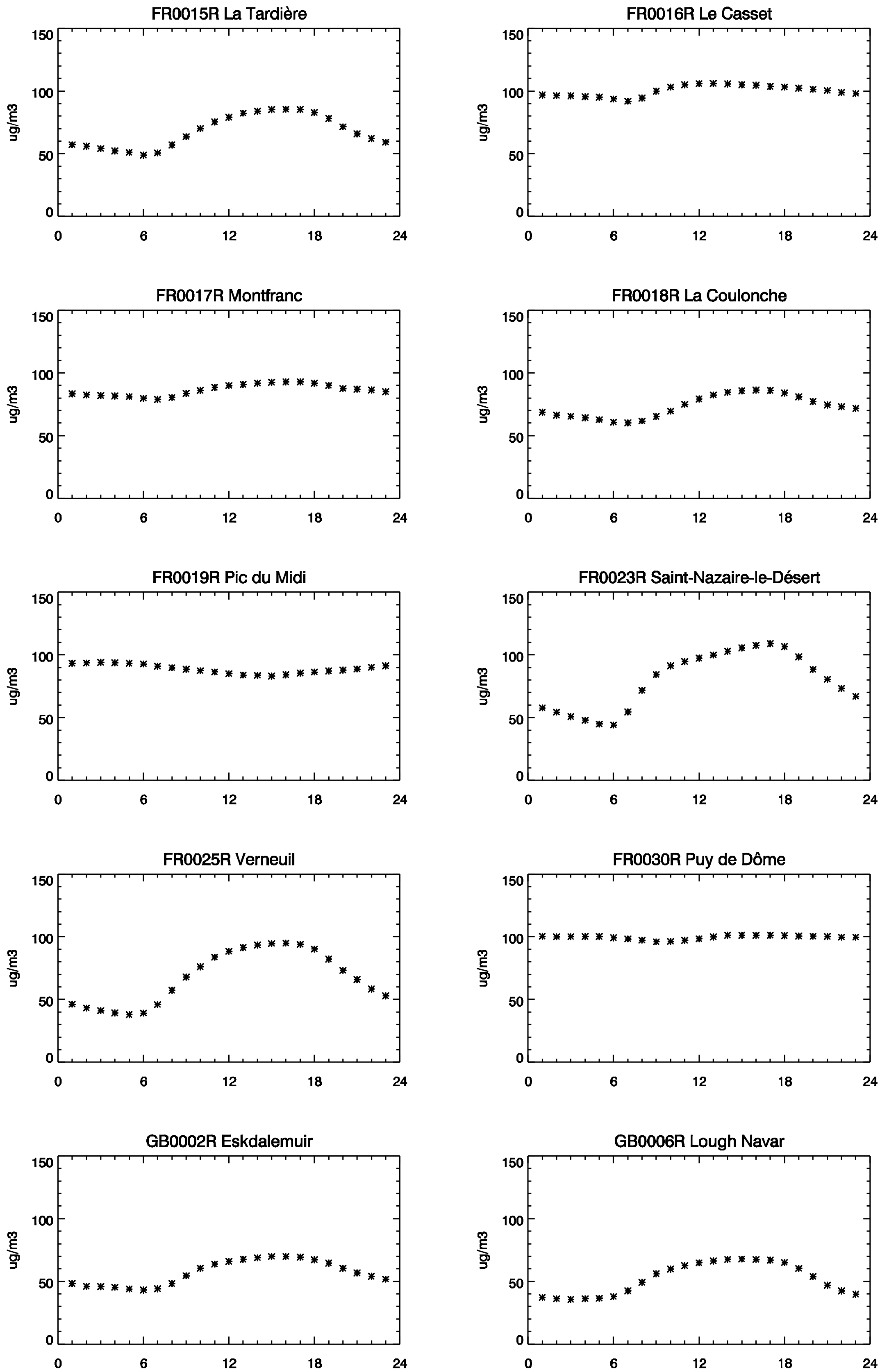

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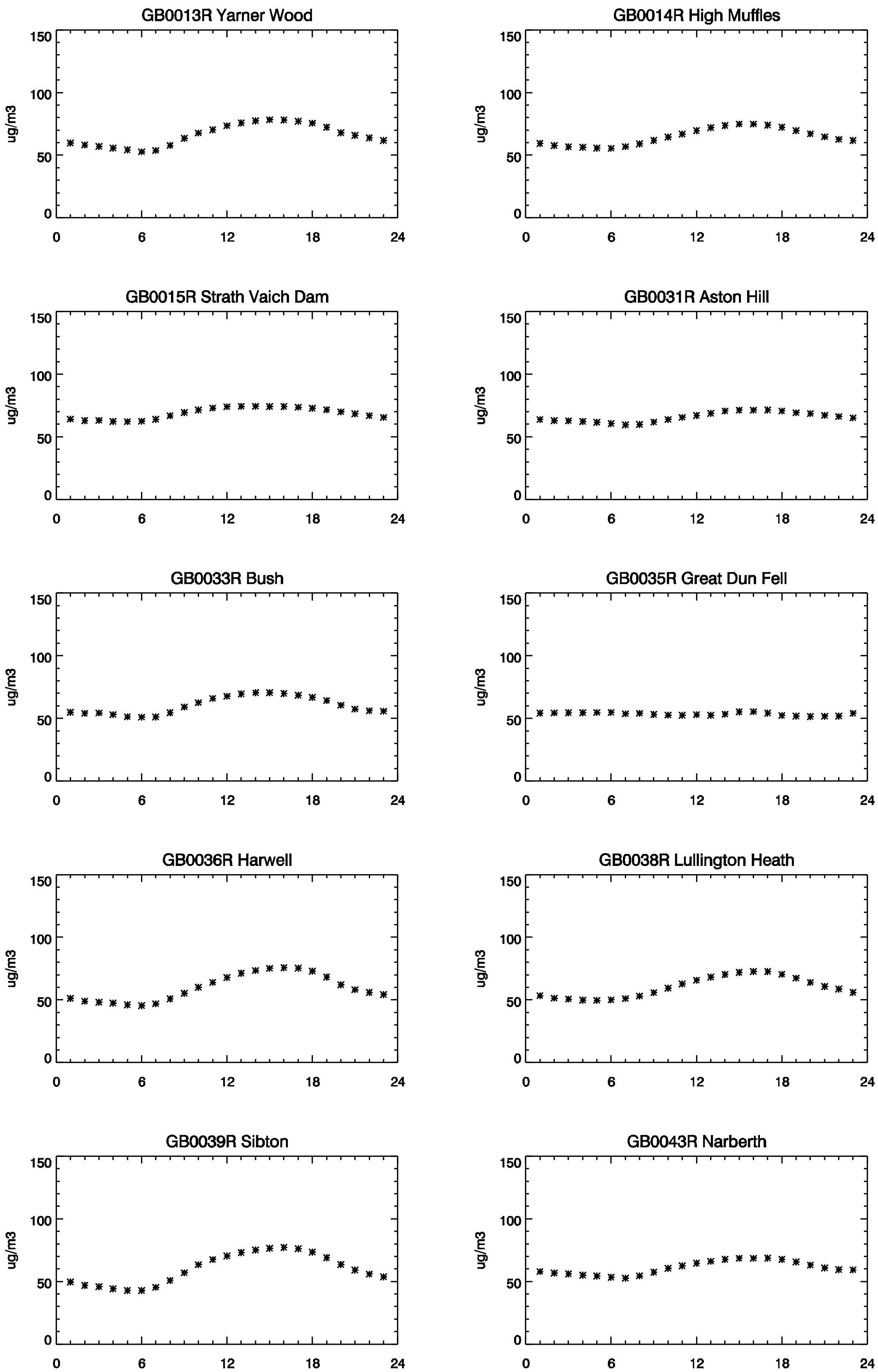

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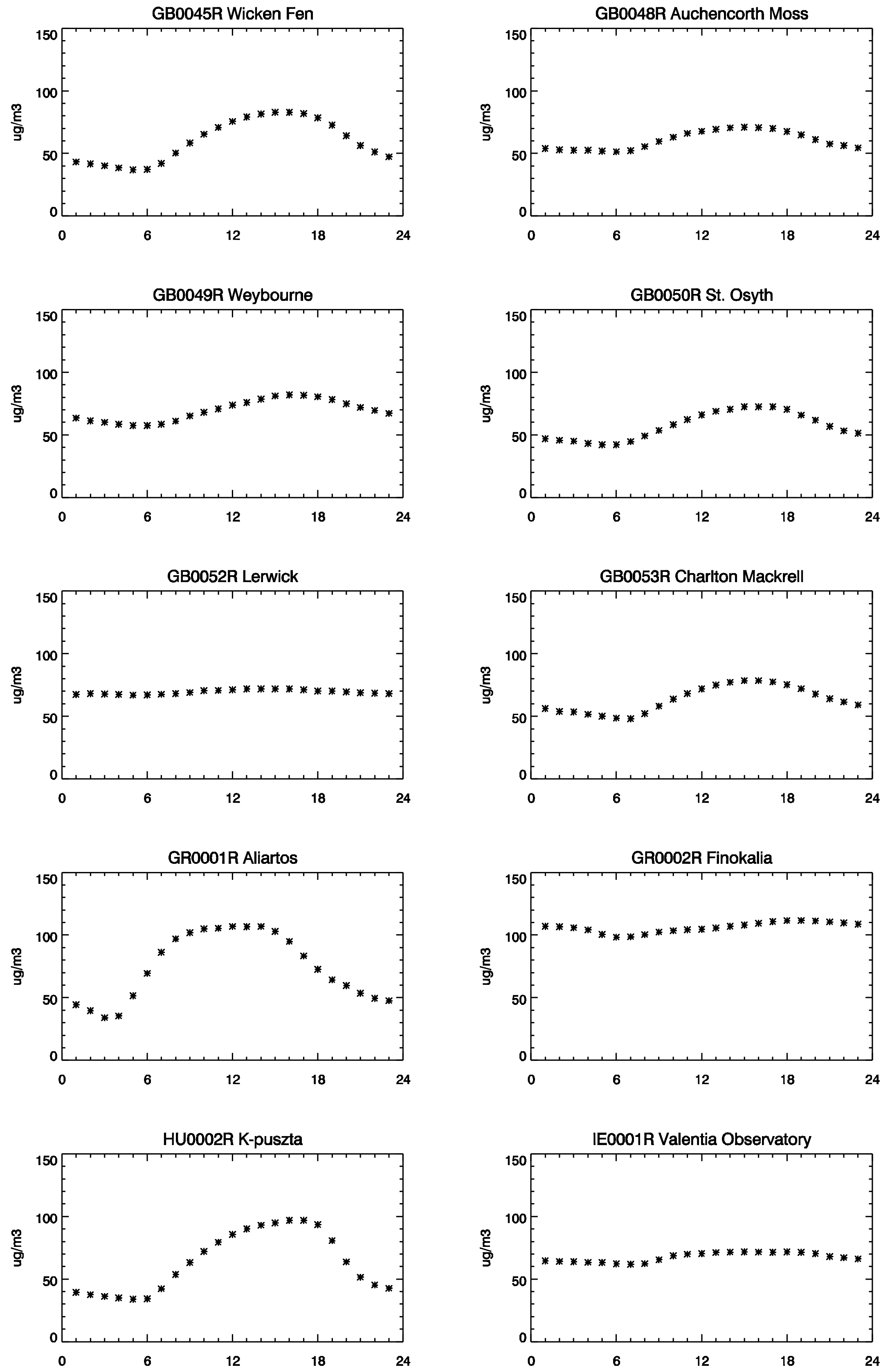

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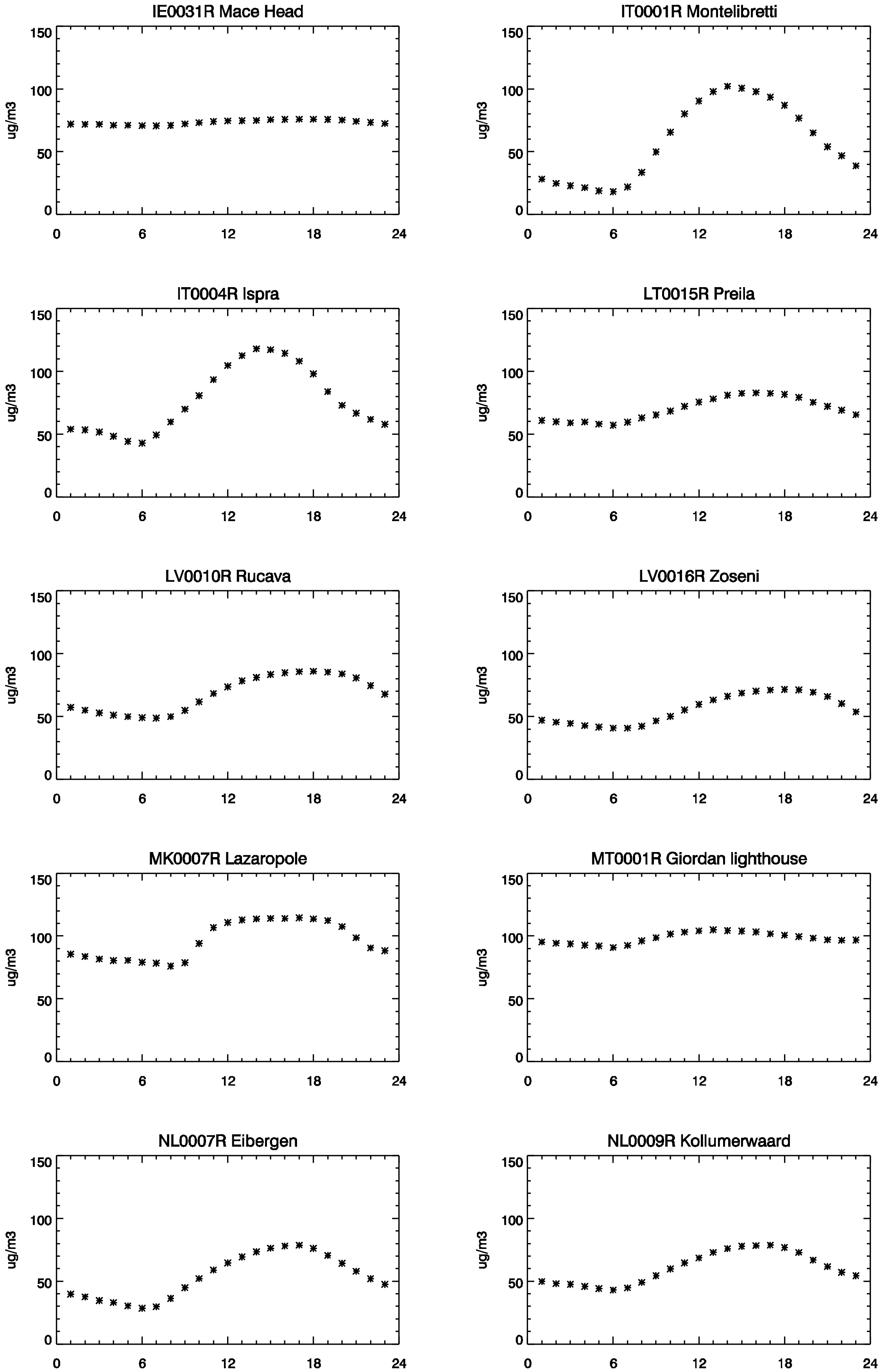

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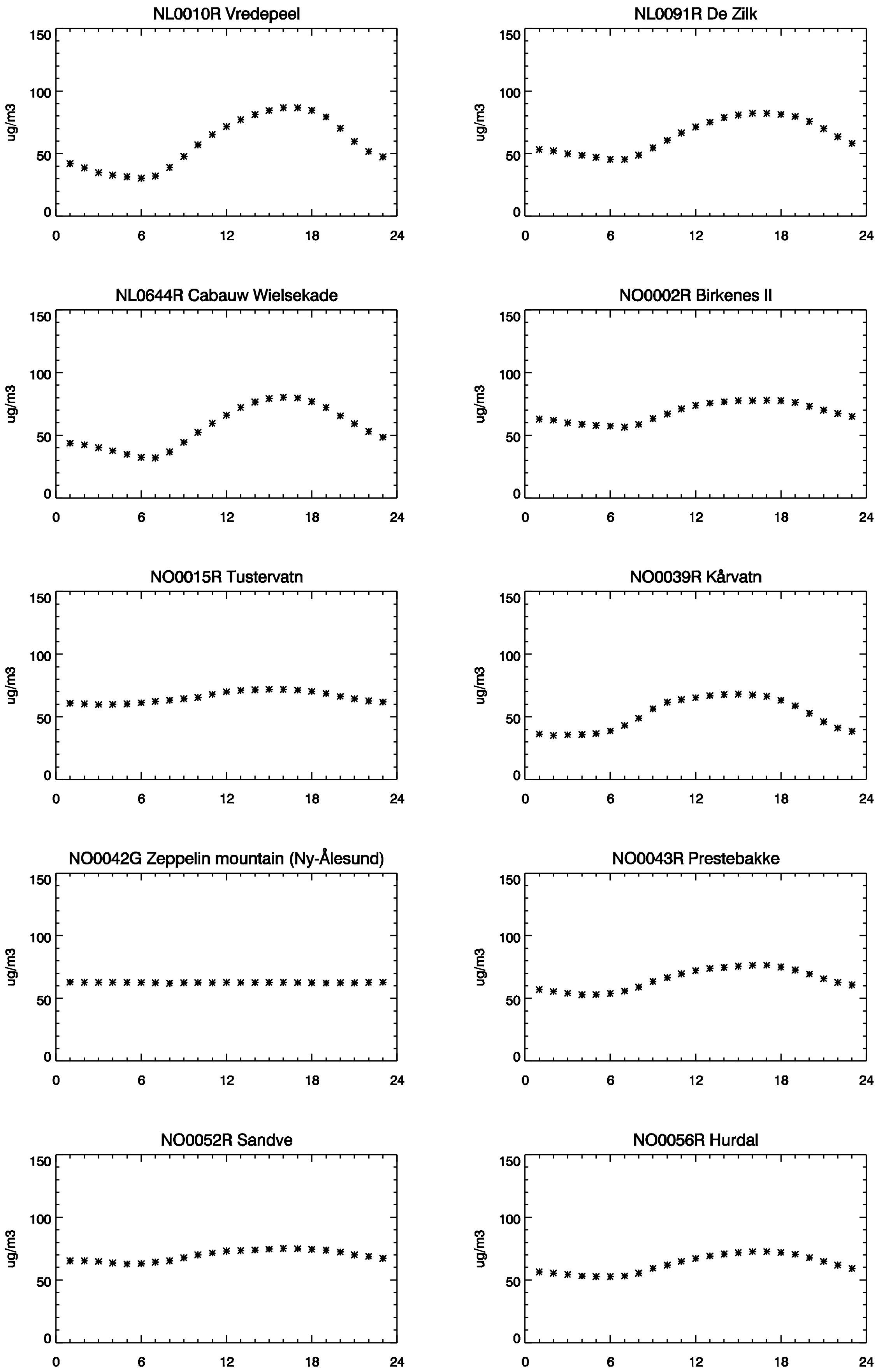

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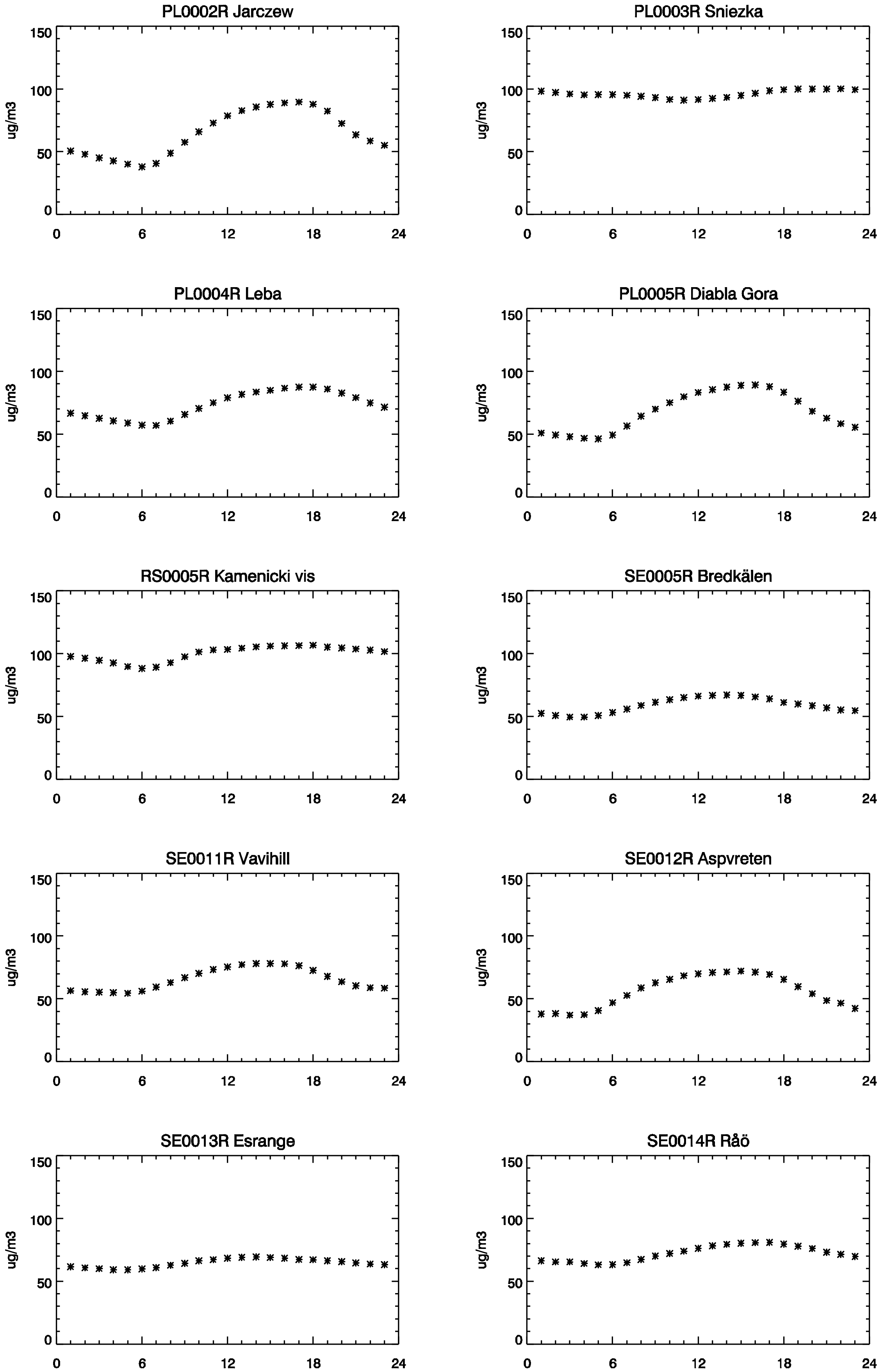

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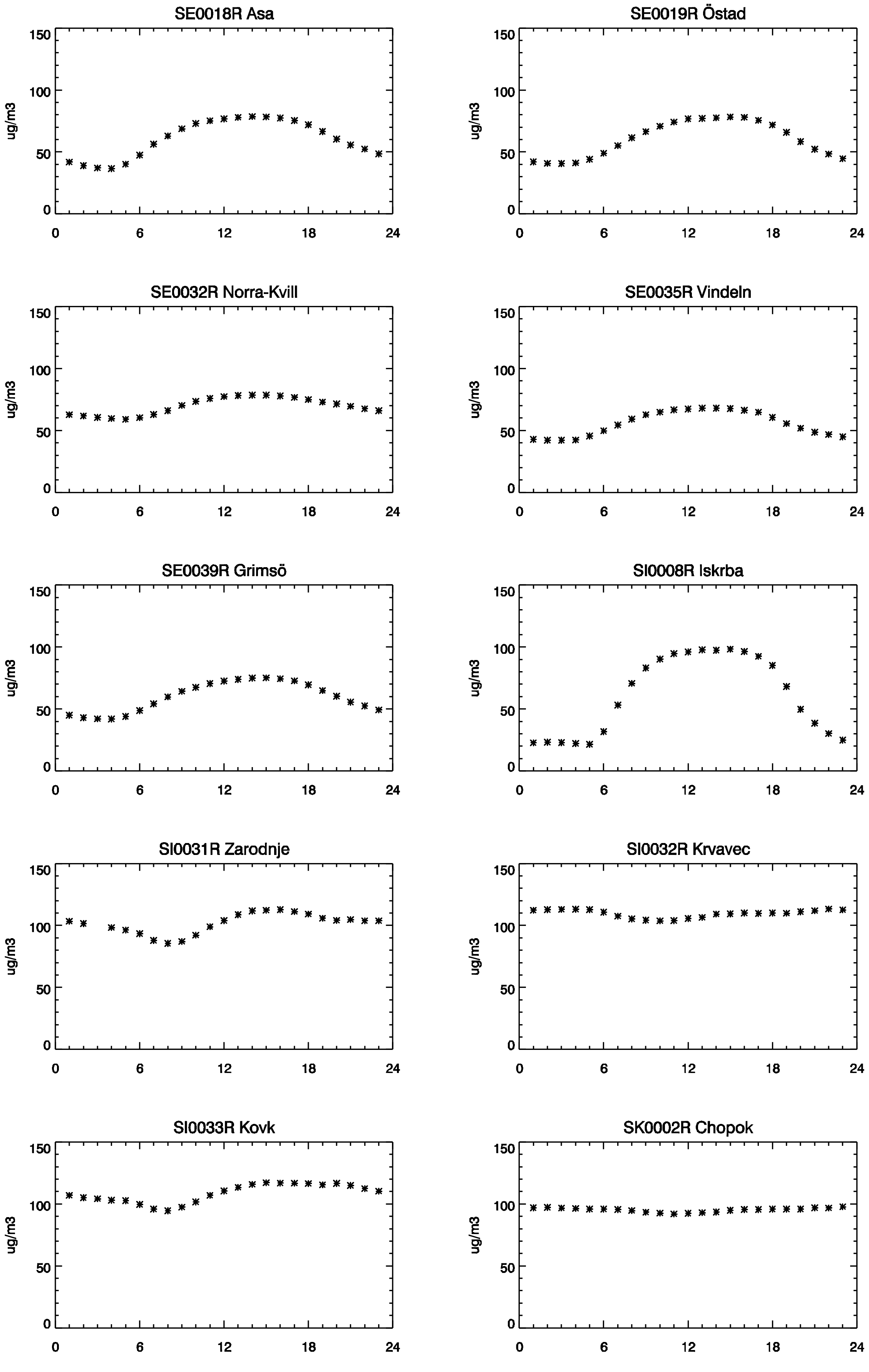

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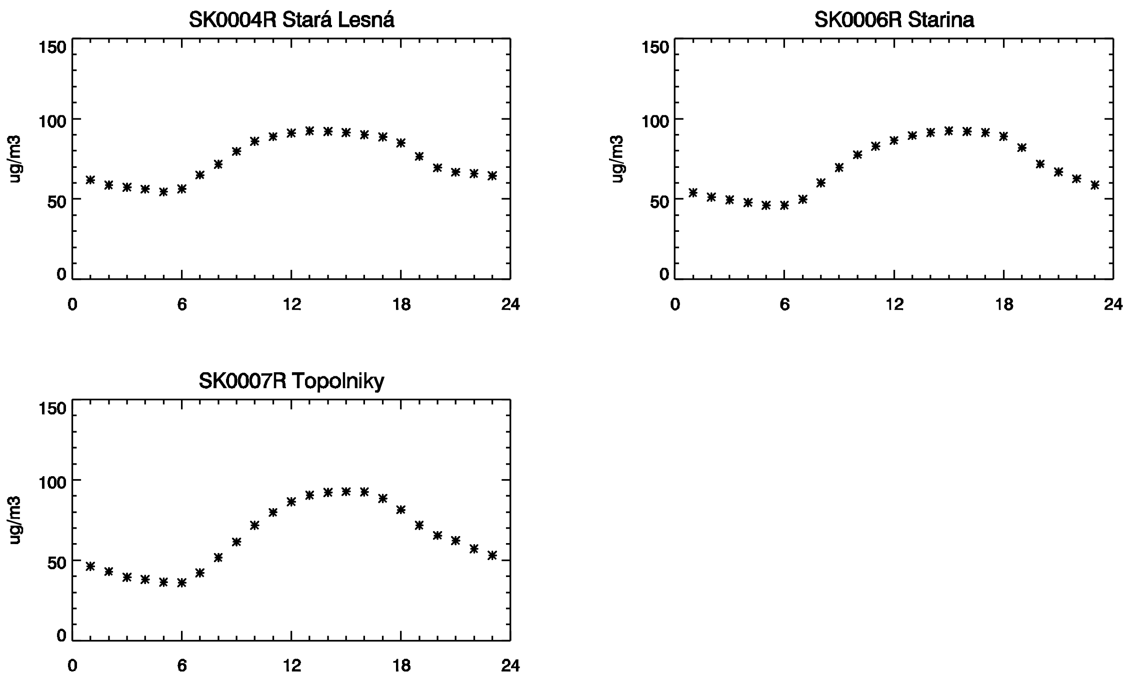

Figure 4.1, cont.

Annex 5

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