Air pollution by ozone across Europe during summer 2008

Overview of exceedances of EC ozone threshold values for April–September 2008

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Executive summary

According to several indicators, ozone levels during the summer of 2008 were the lowest since 1997.

The number and spatial extent of exceedances was lower than in any of the last ten summers. As in most previous years, no exceedances of the information threshold value (180 μg/m³, Directive 2002/3/EC) occurred in northern Europe.

The highest one-hour ozone concentrations of 399 and 302 μg/m³ were observed in Italy (Leonessa and Alatri stations, Lazio region in middle Italy). Several stations in Belgium, Greece, Italy, Spain and Switzerland also reported high hourly ozone concentrations of between 240 and 300 μg/m³.

As in all previous years, the directive's long-term objective to protect human health (maximum ozone concentration of 120 μg/m³ over 8-hours) was exceeded in all EU Member States and other European countries. The target value for human health protection was also exceeded in a significant part of Europe. Nevertheless, both the percentage of Europe's population exposed to ozone levels above the target value and the number of occasions on which the long-term objective was exceeded were the lowest since 1997.

A single episode from 17 June to 5 July 2008 accounted for 40 % of the exceedances of the information threshold, 53 % of exceedances of the alert threshold and 22 % of exceedances of the long-term objective.

Ground-level ozone is one of the air pollutants of most concern in Europe. Moreover, it can no longer be considered only as a local air quality issue — it is a global air pollution problem and an important greenhouse gas.

Ozone pollution is produced by photochemical processes involving nitrogen oxides and volatile organic compounds in the lower atmosphere. Ozone levels become particularly high in regions close to high ozone precursor emissions during summer episodes with stagnant meteorological conditions, when high insolation and temperatures persist. In 2008, levels continued to exceed both target values and the long-term objectives established in EU legislation to protect human health and prevent damage to ecosystems, agricultural crops and materials.

This report provides an evaluation of ground-level ozone pollution in Europe for April–September 2008, based on information submitted to the European Commission under Directive 2002/3/EC on ozone in ambient air. Since Members States have not yet finally validated the submitted data, the conclusions drawn in this report should be considered as preliminary.

Directive 2002/3/EC (European Parliament and Council of the European Union, 2002) requires Member States to report exceedances of the information threshold and alert threshold values (set out in Table 1.1) to the Commission before the end of the month following an occurrence. Furthermore, by 31 October the Member States must provide additional information for the summer period. This should include data on exceedances of the long-term objective for the protection of human health (daily maximum 8-hour average concentrations of 120 μg/m³).

In order to provide information as promptly as possible, summaries of the monthly data provided by the countries are made available on the European Topic Centre on Air and Climate Change website: http://etc-acc.eionet.europa.eu/databases/o3excess.

In July 2006 EEA launched a pilot near real-time ozone website (http://www.eea.europa.eu/maps/ozone), which shows ground level ozone levels across Europe. The site was developed by the EEA as a joint European project and provides up-to-date information in the form of maps and graphs (see Annex 3).

Overview of ozone air pollution in summer 2008

All 27 EU Member States provided information to the European Commission on observed one-hour exceedances and on long-term objective exceedances. In addition, eight other countries (Bosnia and Herzegovina, Croatia, Iceland, Liechtenstein, Norway, Serbia, Switzerland, Turkey and the former Yugoslav Republic of Macedonia) supplied information to the EEA upon request.

According to several indicators, ozone levels during the summer of 2008 were the lowest since reporting of Europe-wide data commenced in 1997. One episode, recorded in northern Italy at the end of July, was particularly noteworthy. In the rest of Europe there were fewer exceedances of the information threshold during summer 2008 than in previous years.

Main findings

In total 2 049 ozone monitoring sites reported data, of which 1 998 were located in EU Member States. The following preliminary conclusions can be drawn from the period April–September 2008:

Exceedance of the information threshold

- The percentage of ozone monitoring stations reporting exceedances of the information threshold (180 $\mu g/m^3$ of one-hour ozone concentration) was the lowest since reporting of Europe-wide data commenced in 1997. Ozone concentrations higher than the information threshold were reported from monitoring sites in 16 EU Member States and four non-member countries. The information threshold was exceeded at approximately 21 % of all operational stations. By comparison, 27 % of stations reported exceeding the threshold in summer 2007, which at the time represented the lowest number of exceedances to date.

- Exceedances of the information threshold were observed over a much less extensive geographical area than in previous years. As in all previous years except summer 2006, no exceedances occurred in the northern part of Europe. The highest number of exceedances was observed in northern Italy and at several locations around the Mediterranean (southern France, Greece, Italy, Portugal, Slovenia and the former Yugoslav Republic of Macedonia).

Exceedance of the alert threshold

- Ozone concentrations higher than the alert threshold of 240 $\mu g/m^3$ were reported on 21 occasions. They occurred in only four EU Member States (Belgium, Greece, northern Italy and Spain) and in Switzerland.

- Exceedances of the alert threshold were observed at locations where also the information threshold was most often exceeded. Most stations (57 %) reporting an exceedance of the alert threshold did so on just one day; only 28 % of stations reported more than two days of exceedances and no station reported more than six days.

Maximum concentrations

- The highest one-hour ozone concentrations of 399 and 302 $\mu g/m^3$ were observed in Italy (Leonessa and Alatri stations, Lazio region in middle Italy). High, hourly ozone concentrations of between 240 and 300 $\mu g/m^3$ were reported a total of 43 times in Belgium, Greece, Italy, Spain and Switzerland.

Exceedance of the long-term objective for the protection of human health (LTO)

- As in previous years, exceedances of the long-term objective for the protection of human health, i.e. daily maximum 8-hour average concentrations higher than 120 $\mu g/m^3$, were observed in every country, in every summer month and at most stations during the summer of 2008. Approximately 85 % of all stations reported one or more exceedances.

- The number of exceedance days per country ranged from 4 (Turkey) to 167 (Italy) and 168 (Spain). On every single day during the summer of 2008 (except 23 September) at least one of the 2 049 operational stations in Europe reported exceeding the LTO. Stations that observed one or more LTO exceedances on average reported 18 days of exceedance, ranging between one and 143 days in the course of the summer.

(1) Daily, maximum, 8-hour, average concentrations were compared with legal objectives set solely for indicative purposes for assessing the current situation and its distance from objectives, and not for checking compliance with Directive 2002/3/EC. As reports of daily maximum of 8-hour average concentrations of ozone started in 2004, exceedances of TVs presented in this report are counted for indicative purposes in cases where LTO limits have been exceeded more than 25 times during the assessed summer period.

Exceedance of the target value (TV) for the protection of human health (1)

- 1 The TV is exceeded when the LTO has been exceeded at a particular station more than 25 times per calendar year, averaged over three years. Over the period 2006–2008, this occurred in 17 EU Member States (Austria, Bulgaria, the Czech Republic, France, Germany, Greece, Hungary, Italy, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, the Slovak Republic, Slovenia and Spain) and in two non-member countries (Croatia and the former Yugoslav Republic of Macedonia).

- 1 Target value exceedances occurred at 19 % of all monitoring stations providing reports.

- 1 The target value was exceeded in approximately 14 % of the area assessed and affected approximately 13 % of the total population (2). In summer 2007 target value exceedances affected 28 % of both the assessed area and the total population.

Main ozone episodes

- 1 Unlike in previous years there was no distinct ozone episode during the summer 2008, with the exception of an episode over southern Europe during late June, mostly located over northern and central Italy and the West Balkan countries (Croatia) (3). The episode occurred from 17 June to 5 July, peaking on 25–27 June. This episode accounted for 40 % of the total number of exceedances of the information threshold recorded in Europe in summer 2008, 53 % of exceedances of the alert threshold and 22 % of LTO exceedances were observed.

Comparison with previous years

According to several indicators, the ozone level during the summer of 2008 ranks as the lowest in the past decade and the spatial extent of the observed exceedances was much less extensive than in previous years.

Disclaimer

The preliminary summary contains summary information based on data delivered before 13 November 2008.

The information describing the situation during summer 2008 is based on non-validated monitoring data and should therefore be regarded as preliminary.

(2) See Section 2.2 for calculation details. The figures for percentages of area and population affected are not comparable with those in summer reports for 2004, 2005 and 2006 because of different spatial distribution maps preparation — see Section 2.3.
(3) For a definition of the term 'ozone episode' please refer to the EEA glossary, available at http://glossary.eea.europa.eu/.

1 Introduction

Ozone is the main product of complex photochemical processes in the lower atmosphere involving oxides of nitrogen and volatile organic compounds as precursors. Ozone is a strong photochemical oxidant. In elevated concentrations it causes serious health problems and damage to ecosystems, agricultural crops and materials. The main sectors that emit ozone precursors are road transport, power and heat generation plants, household (heating), industry, and petrol storage and distribution.

In view of the harmful effects of photochemical pollution of the lower levels of the atmosphere, the European Council adopted Directive 92/72/EEC on air pollution by ozone. That directive was succeeded by Directive 2002/3/EC of the European Parliament and of the Council relating to ozone in ambient air. Directive 2002/3/EC is also known as the third daughter directive to the Air Quality Framework Directive 96/62/EC. It sets long-term objectives and target values, and an alert threshold and information threshold for ozone (Table 1.1), for the purpose of avoiding, preventing or reducing the harmful effects on human health and environment. It provides common methods and criteria for assessing ozone concentrations in ambient air, and ensures that adequate information is made available to the public on the basis of this assessment. It also promotes cooperation between the Member States in reducing ozone levels.

On 14 June 2008, the new Directive 2008/50/EC on ambient air quality and cleaner air for Europe ([4]) came into force. The provisions of earlier air quality directives (96/62/EC, 1999/30/EC, 2000/69/EC and 2002/3/EC) remain in force until 11 June 2010 when they will be largely repealed by Directive 2008/50/EC. The new directive will not change the existing target value, long-term objective, alert threshold or information threshold.

This report gives an overview of reported ground-level ozone concentrations between April and September 2008, and provides a comparison with the last ten years. The EEA has prepared similar overviews since 1994. Previous reports are available from the EEA website: http://www.eea.europa.eu.

The legal requirements for the reporting provisional data on exceedances of the long-term objectives, targets and threshold values for ozone during the summer, which are the basis of this report, are summarised in Annex 1.

Table 1.1 Ozone threshold values, long-term objective and target value for the protection of human health, as set out in Directive 2002/3/EC

Objective	Level (μg/m³)	Averaging time
Information threshold (IT)	180	One-hour
Alert threshold (AT)	240	One-hour
Long-term objective (LTO)	120	8-hour average, daily maximum
Target value (TV)	120, not to be exceeded more than 25 days per calendar year *	8-hour average, daily maximum

Note: * Averaged over three years and to be achieved where possible by 2010.

([4]) Directive 2008/50/EC of the European parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. OJ L 152, 11.6.2008, p. 1.

2 Ozone air pollution in summer 2008

According to several indicators, ozone levels recorded during summer 2008 were the lowest since reporting of Europe-wide data commenced in 1997. Details on reported data and ozone monitoring networks are provided in Annex 2.

This chapter provides detailed country-by-country, month-by-month and day-by-day tabular, graphic and geographical information on threshold exceedances. The largest threshold exceedance episode is also described.

2.1 Summary of reported hourly exceedances

Ozone concentrations in excess of the information threshold were reported from monitoring sites in sixteen EU Member States and four non-member countries (Table 2.1).

The percentage of stations that recorded exceedances was the lowest since Europe-wide data reporting commenced in 1997. As in all previous years except summer 2006, no exceedances occurred in northern Europe. The highest numbers of exceedances were observed in northern Italy and at several other locations in southern Europe (southern France, Greece, Italy, Portugal, Slovenia and the former Yugoslav Republic of Macedonia).

Table 2.2, Figure 2.1 and Figure 2.6 present the distribution of hourly exceedances during the season. The highest number of exceedances occurred during June and July 2008, which respectively accounted for approximately 35 % and 36 % of all observed information threshold exceedances and about 53 % and 18 % of alert threshold exceedances ([5]). The percentages for August (20 % of information threshold exceedances and 27 % of alert threshold exceedances) were higher that in previous years. For the summer as a whole, the occurrence of information and alert thresholds exceedances was the lowest on record (Table 3.1).

Figure 2.2 presents the frequency distribution of hourly ozone concentrations that exceeded the information threshold. For each Member State that submitted data, the graph uses box plots to indicate the minimum exceedance value, the maximum, and the 25th and 75th percentile values.

In Europe as a whole, 25 % of exceedances were below 185 µg/m^3 (compared to 207 µg/m^3 in 2003, 185 µg/m^3 in 2004, 186 µg/m^3 in 2005, 2006 and 2007). Seventy-five per cent were below 206 µg/m^3 (compared to 305 µg/m^3 in 2003, 203 µg/m^3 in 2004, 206 µg/m^3 in 2005, 2006 and 2007).

2.2 Overview of exceedances of the long-term objective and target value for the protection of human health

As in all previous years, during summer 2008 at least one daily maximum 8-hour average concentration of ozone over 120 µg/m^3 (the long-term objective, LTO) was observed in every country, in every summer month and at most stations (see Table 2.3). The TV is exceeded when the LTO has been exceeded at a particular station more than 25 times per calendar year, averaged over three years).

Table 2.4 presents the LTO exceedances on a monthly basis and Figure 2.6 shows them on a day-by-day and country basis. Approximately 85 % of all stations reported at least one exceedance of the LTO. There was only one day (23 September) without an exceedance in Europe in the summer of 2008. The highest number of exceedances occurred during July (28 % of all observed exceedances) May (25 %) and June (22 %). In total, the occurrence of LTO exceedances was the lowest since reporting of Europe-wide data commenced in 1997 (Table 3.2).

The frequency distribution of 8-hour ozone concentrations exceeding the long-term objective level is shown in Figure 2.4. In Europe as a whole,

([5]) In this report, one-hour exceedances are counted on a daily basis, i.e. each day on which a station records ozone levels above the information or alert threshold for at least one hour is counted as one exceedance.

Table 2.1 Overview of exceedances of one-hour thresholds during the summer of 2008 on a country-by-country basis ([6])

Country	No. of stations ([a])	Stations with exceedance ([b])					Number of days with exceedance ([c])		Maximum observed one-hour concentration (μg/m³)	Occurrence of exceedances ([d])				Average duration of exceedances (hour)	
		(number)		(%)		(%)									
Austria	117	11	0	9	-	-	10	-	210	0.1	1.3	-	-	1.2	-
Belgium	40	11	1	28	3	9	4	1	243	0.3	1.2	0	1	1.9	1
Bulgaria	12	3	0	25	-	-	3	-	218	0.3	1	-	-	1.7	-
Cyprus	2	0	0	-	-	-	-	-	142	-	-	-	-	-	-
Czech Republic	59	5	0	8	-	-	3	-	222	0.1	1.2	-	-	1.5	-
Denmark	7	0	0	-	-	-	-	-	150	-	-	-	-	-	-
Estonia	7	0	0	-	-	-	-	-	161	-	-	-	-	-	-
Finland	16	0	0	-	-	-	-	-	153	-	-	-	-	-	-
France	446	62	0	14	-	-	28	-	236	0.3	2	-	-	1.9	-
Germany	282	76	0	27	-	-	13	-	236	0.4	1.5	-	-	2.5	-
Greece	24	13	4	54	17	31	53	8	281	6.3	11.5	0.5	3	2.9	1.5
Hungary	17	0	0	-	-	-	-	-	176	-	-	-	-	-	-
Ireland	10	0	0	-	-	-	-	-	153	-	-	-	-	-	-
Italy	259	134	14	52	5	10	83	14	399	3	5.8	0.1	2.1	3.2	1.8
Latvia	7	0	0	-	-	-	-	-	147	-	-	-	-	-	-
Lithuania	13	0	0	-	-	-	-	-	169	-	-	-	-	-	-
Luxembourg	6	1	0	17	-	-	3	-	196	0.5	3	-	-	2.3	-
Malta	3	0	0	-	-	-	-	-	170	-	-	-	-	-	-
Netherlands	37	3	0	8	-	-	2	-	200	0.1	1	-	-	2.3	-
Poland	64	5	0	8	-	-	3	-	187	0.1	1	-	-	1.8	-
Portugal	49	17	0	35	-	-	14	-	240	0.8	2.3	-	-	2.6	-
Romania	23	3	0	13	-	-	6	-	225	0.3	2.3	-	-	2.7	-
Slovak Republic	13	2	0	15	-	-	2	-	189	0.2	1	-	-	1.5	-
Slovenia	12	1	0	8	-	-	3	-	187	0.3	3	-	-	1.7	-
Spain	382	45	1	12	0	2	25	1	241	0.2	1.8	0	1	2	1
Sweden	12	0	0	-	-	-	-	-	157	-	-	-	-	-	-
United Kingdom	79	1	0	1	-	-	3	-	194	0	3	-	-	1.7	-
EU area	**1 998**	**393**	**20**	**20**	**1**	**5**	**120**	**23**	**399**	**0.7**	**3.4**	**0**	**2.2**	**2.8**	**1.7**
Bosnia and Hercegovina	2	1	0	50	-	-	4	-	239	2	4	-	-	1.3	-
Croatia	2	1	0	50	-	-	2	-	195	1	2	-	-	3	-
Iceland	2	0	0	-	-	-	-	-	136	-	-	-	-	-	-
Liechtenstein	1	0	0	-	-	-	-	-	161	-	-	-	-	-	-
the former Yugoslav Republic of Macedonia	12	5	0	42	-	-	22	-	218	2.9	7	-	-	6.1	-
Norway	8	0	0	-	-	-	-	-	160	-	-	-	-	-	-
Serbia	1	0	0	-	-	-	-	-	166	-	-	-	-	-	-
Switzerland	20	2	1	10	5	50	13	1	247	1.1	11	0.1	1	3.4	2
Turkey	3	0	0	-	-	-	-	-	170	-	-	-	-	-	-
Whole area	**2 049**	**402**	**21**	**20**	**1**	**5**	**124**	**23**	**399**	**0.7**	**3.5**	**0**	**2.1**	**2.9**	**1.7**

Notes: White columns refer to exceedances of the information threshold, grey to exceedances of the alert threshold.

'-' indicates 'not applicable'.

([a]) Total number of stations measuring ozone levels.

([b]) The number and percentage of stations at which at least one threshold exceedance was observed;
fifth column: percentage of stations with information threshold exceedance at which alert threshold exceedance were also observed.

([c]) The number of calendar days on which at least one exceedance of thresholds was observed.

([d]) Occurrence of exceedance is calculated as the average number of exceedances observed per station in a country. Left column: averaged over all implemented stations (total number of stations), right figure: averaged over all stations which reported at least one exceedance.

([6]) Unless otherwise stated, all tables and graphs have been compiled using data submitted by countries to EEA.

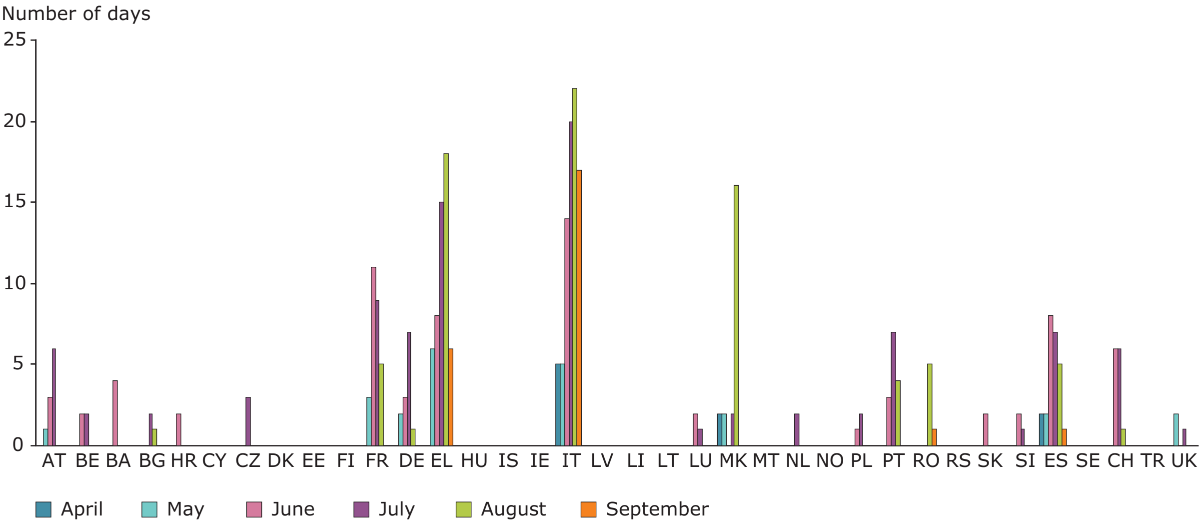
Table 2.2 Overview of exceedances of one-hour thresholds in Europe during the summer of 2008, on a month-by-month basis

Month	Stations with exceedance (b)					Number of days with exceedance (c)		Maximum observed one-hour concentration (µg/m³)	Occurrence of exceedances (d)				Average duration of exceedances (hour)	
	(number)		(%)		(%)									
April	8	0	0	-	-	8	-	220	0	0	-	-	2.2	-
May	21	0	1	-	-	20	-	217	0	0.1	-	-	2.1	-
June	229	14	11	1	6	20	9	399	0.2	1.2	0	1.1	3.1	1.9
July	246	7	12	0	3	27	5	256	0.2	1.3	0	0.4	2.8	1.4
August	107	8	5	0	7	29	8	281	0.1	0.7	0	0.6	3.3	1.4
September	43	1	2	0	2	20	1	302	0	0.2	0	0	1.8	2

Note: (b)–(d) see notes to Table 2.1.

Figure 2.1 Number of days on which at least one exceedance of the one-hour threshold value was observed per country and per month during the summer of 2008 (only countries that submitted data are shown)

a) Information threshold exceedances



b) Alert threshold exceedances

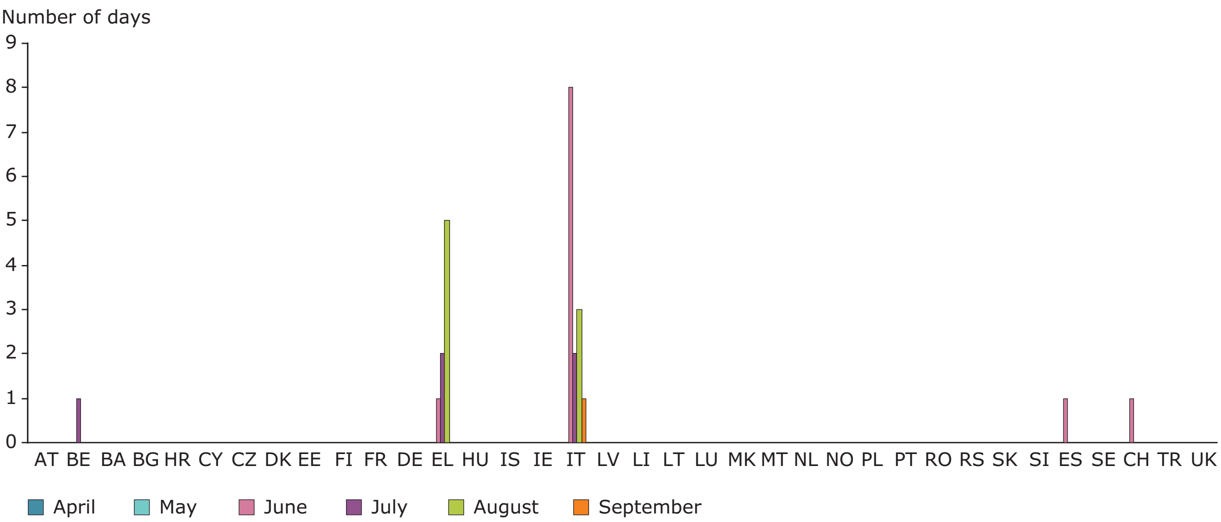
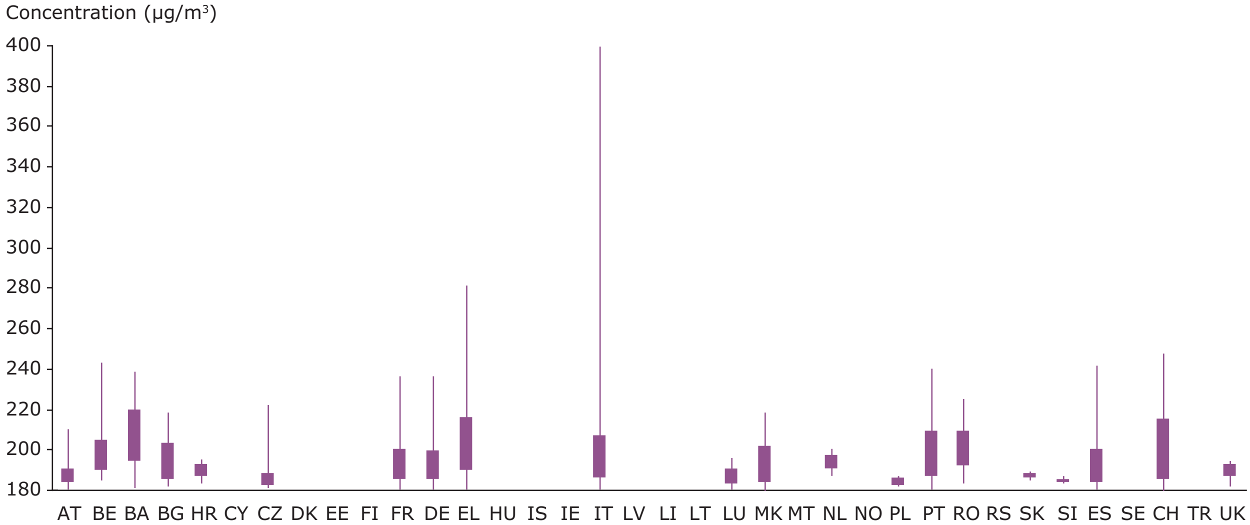


Figure 2.2 Frequency distribution of concentrations in excess of the one-hour information threshold during summer 2008 (only countries that delivered data are shown)



Note: Presented as box plots indicating the minimum, the 25th percentile, the 75th percentile and the maximum value.

25 % of maximum 8-hour concentrations of all the observed exceedances were below 125 μg/m^3 (125 μg/m^3 in 2007, 2005 and 2004, 127 μg/m^3 in 2006). Seventy-five per cent were below 138 μg/m^3 (143 μg/m^3 in 2004, 144 μg/m^3 in 2005, 148 μg/m^3 in 2006 and 140 μg/m^3 in 2007).

2.3 Geographical distribution of ozone air pollution

The spatial distribution of exceedance of ozone air pollution throughout Europe is similar from year to year. In 2008, the highest ozone levels were found in southern and central Europe, where widespread exceedances of both the threshold and target values for the protection of human health occurred. As in previous summers western, north-western and northern Europe were not widely affected.

The lowest ozone levels occurred in the Baltic States, Scandinavia and a large part of western Europe. No exceedances of the information threshold were reported from this area in the summer 2008. This area also reported the fewest exceedances of the LTO.

Map 2.1 depicts the number of days on which the one-hour information threshold was exceeded across Europe. The spatial extent of the exceedances observed in the summer of 2008 was less than in the previous four summers. Only northern Italy and a few other isolated locations reported more than 10 exceedance days in summer 2008.

Map 2.2 displays the number of days on which LTO was exceeded across Europe. The areas that reported more than 25 days of LTO exceedance (relevant for determining exceedance of the TV) were much more restricted than in the previous summers (Table 2.5). The target value was exceeded in approximately 14 % of the assessed area and affected approximately 13 % of the total population in the assessed territory (7).

These maps present the number of exceedance days from the rural stations interpolated by the ordinary

(7) Due to an improved applied methodology (see footnote 8, page 15) the percentage shares of affected area and population are not exactly comparable with those in the reports for 2004, 2005 and 2006 summers. If the same methodology were applied as in previous reports, estimated percentage shares of affected area and population for the whole of Europe would be slightly lower (24.8 and 26.1 % respectively. For more details, see: http://air-climate.eionet.europa.eu/reports.

Table 2.3 Overview of exceedances of the long-term objective for the protection of human health during the summer of 2008 on a country-by-country basis

Country	No. of stations (a)	Stations with LTO exceedance (b)		Stations with TV exceedance (c)		Number of days with LTO exceedance (3)	Maximum observed 8-hour concentration (μg/m³)	Occurrence of LTO exceedances (d)	
		(number)	(%)	(number)	(%)				
Austria	117	114	97	25	21	111	168	17.9	18.4
Belgium	40	39	98	-	-	28	174	11.1	11.3
Bulgaria	12	10	83	3	25	62	170	15.2	18.2
Cyprus	2	2	100	-	-	6	129	3.0	3.0
Czech Republic	59	57	97	15	25	75	170	17.7	18.3
Denmark	7	6	86	-	-	20	143	5.7	6.7
Estonia	7	4	57	-	-	11	150	3.0	5.3
Finland	16	11	69	-	-	17	150	2.9	4.2
France	446	413	93	46	10	111	196	12.3	13.3
Germany	282	274	97	49	17	88	204	17.5	18.1
Greece	24	19	79	12	50	162	224	48.7	61.5
Hungary	17	15	88	4	24	82	161	19.4	22.0
Ireland	10	5	50	-	-	12	152	2.1	4.2
Italy	259	216	83	124	48	167	245	26.9	32.2
Latvia	7	2	29	-	-	6	142	1.0	3.5
Lithuania	13	10	77	1	8	39	164	5.9	7.7
Luxembourg	6	4	67	1	17	34	183	10.3	15.5
Malta	3	3	100	1	33	35	149	15.3	15.3
Netherlands	37	25	68	-	-	31	171	4.2	6.2
Poland	64	59	92	14	22	91	178	16.0	17.3
Portugal	49	44	90	1	2	70	202	7.5	8.3
Romania	23	11	48	3	13	71	190	6.7	14.1
Slovak Republic	13	13	100	5	38	88	153	24.2	24.2
Slovenia	12	11	92	4	33	91	168	25.4	27.7
Spain	382	281	74	69	18	168	189	12.2	16.6
Sweden	12	11	92	-	-	20	146	4.2	4.5
United Kingdom	79	52	66	-	-	44	159	2.3	3.4
EU area	**1 998**	**1 711**	**86**	**377**	**19**	**182**	**245**	**15.1**	**17.6**
Bosnia and Hercegovina	2	2	100	-	-	13	138	6.5	6.5
Croatia	2	2	100	1	50	82	174	47.0	47.0
Iceland	2	1	50	-	-	5	126	2.5	5.0
Liechtenstein	1	1	100	-	-	13	146	13.0	13.0
the former Yugoslav Republic of Macedonia	12	11	92	9	75	159	207	56.5	61.6
Norway	8	6	75	-	-	15	149	4.5	6.0
Serbia	1	1	100	-	-	24	147	24.0	24.0
Switzerland	20	5	25	-	-	31	154	3.8	15.2
Turkey	3	1	33	-	-	4	144	1.3	4.0
Whole area	**2 049**	**1 741**	**85**	**387**	**19**	**182**	**245**	**15.2**	**17.9**

Notes: '-' indicates 'not applicable'.

(a) Total number of stations measuring ozone levels.

(b) The number and percentage of stations at which at least one exceedance was observed.

(c) The number of calendar days on which at least one exceedance was observed.

(d) Left column: averaged over all implemented stations,
right figure: averaged over all stations which reported at least one exceedance .

Table 2.4 Overview of exceedances of the long-term objective for the protection of human health in Europe during the summer of 2008, on a month-by-month basis

Month	Stations with LTO exceedance (b)		No. of days with LTO exceedance (c)	Maximum observed 8-hour concentration (μg/m³)	Occurrence of LTO exceedances (d)	
	(number)	(%)				
April	870	42	30	187	1.2	1.4
May	1424	69	31	181	3.8	4.5
June	1381	67	30	245	3.3	3.9
July	1425	70	31	222	4.3	5.1
August	853	42	31	224	2.1	2.5
September	281	14	29	211	0.4	0.4

Note: (b)–(d) see notes to Table 2.3.

Figure 2.3 Number of days on which at least one exceedance of the long-term objective for the protection of human health was observed per country and per month during the summer of 2008 (only countries that delivered data are shown)

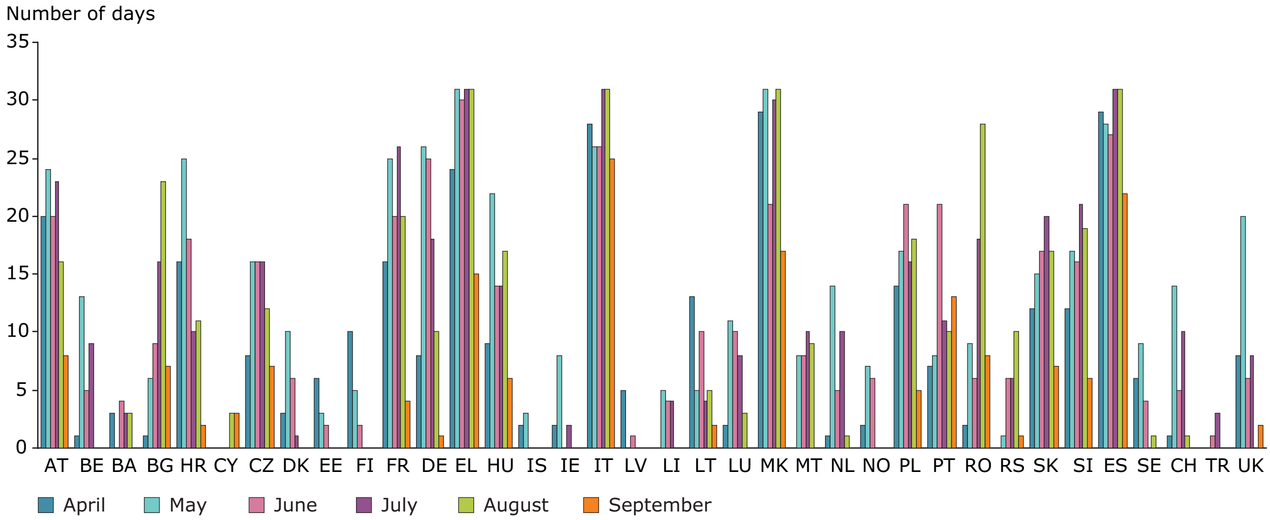
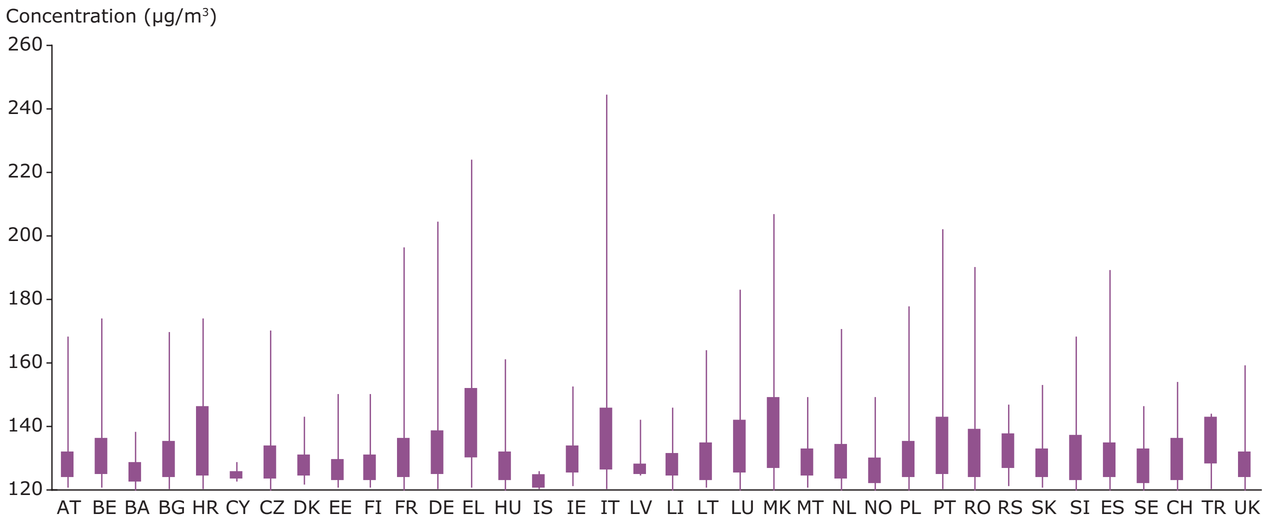
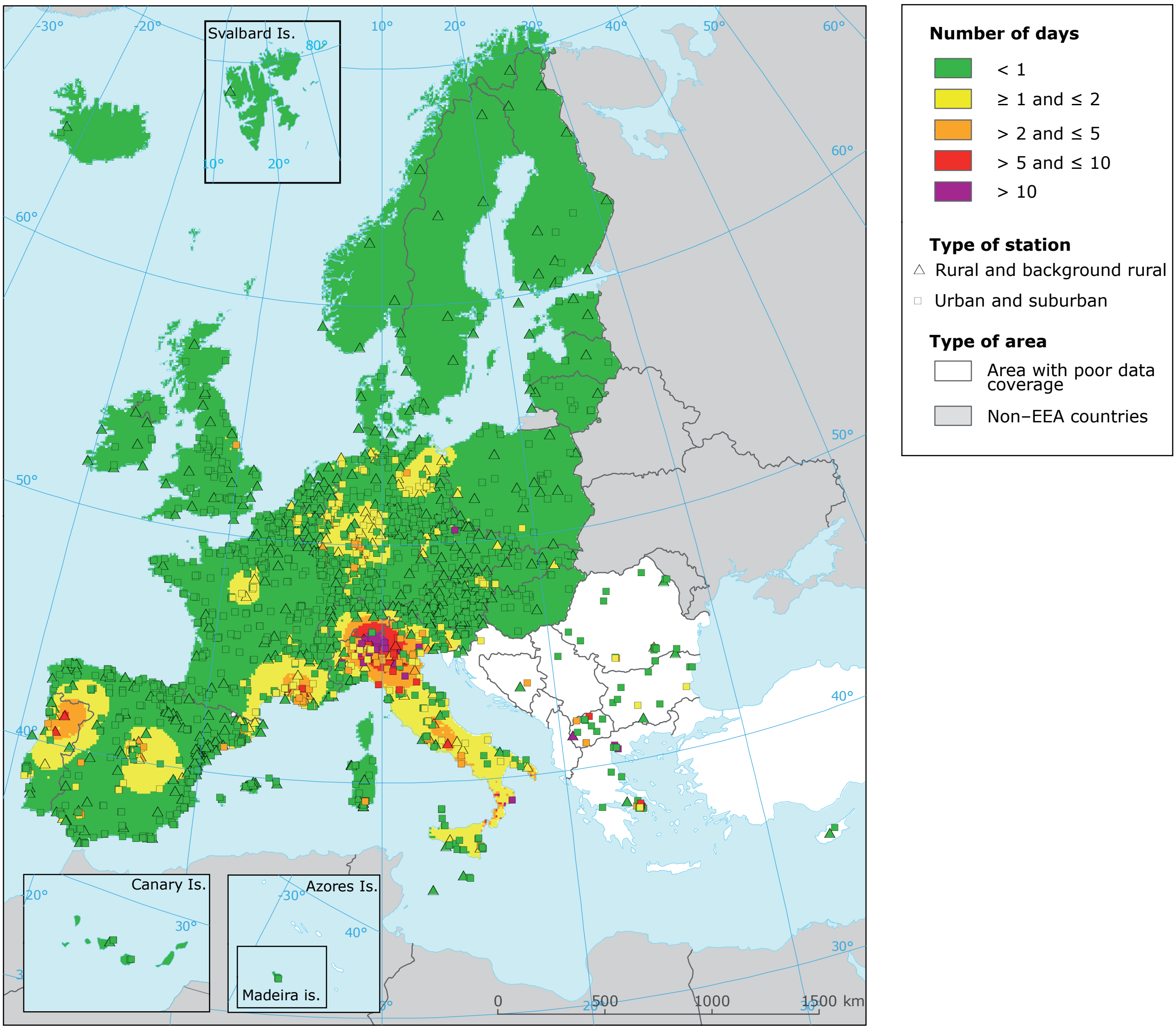


Figure 2.4 Frequency distribution of concentrations in excess of the long-term objective for the protection of human health during the summer of 2008 (only countries that delivered data are shown)



Note: Presented as box plots indicating the minimum, the 25th percentile, the 75th percentile and the maximum value.

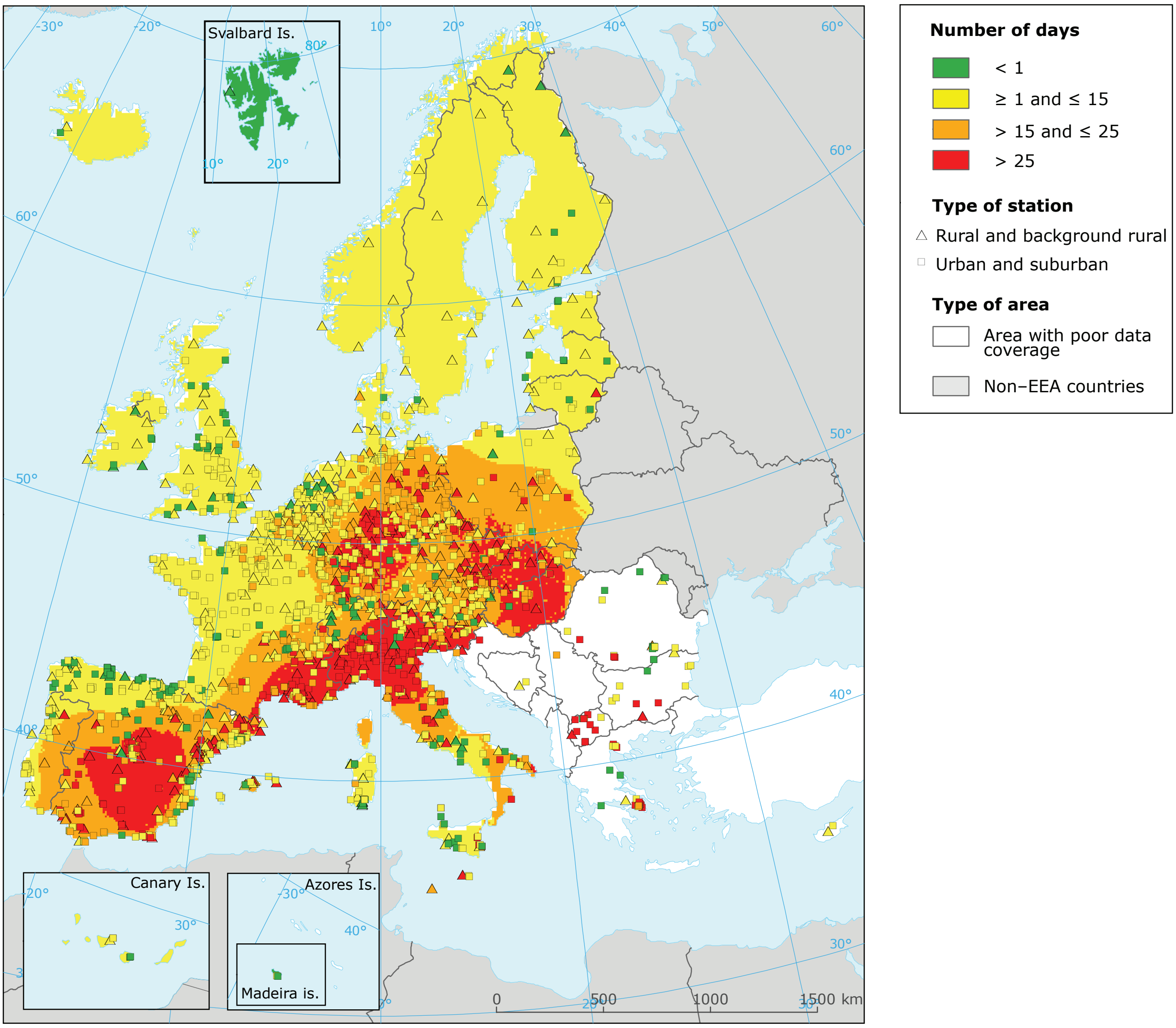
Map 2.1 Number of days on which ozone concentrations exceeded the information threshold



kriging method (Cressie, 1993) — a geostatistical method based on knowledge of the air quality field spatial structure ([8]). The colour coding is standard for station symbols as well as for interpolated maps.

([8]) The use of the kriging method is supported by works dealing with spatial mapping development (van de Kassteele *et al.*, 2005). Ozone exceedances are interpolated separately for rural and urban areas. The reason is the different character of urban and rural air pollution concentration fields. The final map is constructed by merging separately created rural and urban maps. In 2007 a European-wide population density grid was used to merge the rural map and the urban map into one combined map. Both the rural and the urban maps were created for the entire continent. The population density grid helps determine which part of the respective maps is used (Horálek *et al.*, 2007). Using a population density map to assess air quality in urban areas enables the situation there to be estimated without measurement, thereby improving overall assessment compared with the methodology used in previous reports.
The density of ozone monitoring sites is too low to provide reliable estimates of spatial distribution by interpolation for the south-eastern part of Europe and, therefore, no spatial distribution is shown in these areas.
The type of station was unknown for approximately 6 % of stations. This fact could affect the precision of mapping in some areas.

Map 2.2 Number of days on which ozone concentrations exceeded the long-term objective for the protection of human health



2.4 Main ozone episode

Ozone formation in the atmosphere is a complicated, non-linear photochemical process. In the troposphere (the lower part of the atmosphere), ozone formation results from a chain of mechanisms involving photochemical reactions of nitrogen oxides, chained with oxidative decomposition of volatile organic compounds, carbon monoxide (CO) and methane, initiated by hydroxyl radicals.

Episodes with elevated ozone levels occur during periods of warm, sunny weather. The ozone concentration depends on meteorological conditions. The largest ozone episodes with the highest ozone concentrations occur in areas of high air pressure (anticyclones). Within such areas, the prevailing stagnant conditions mean that emissions of ozone precursors are only slowly dispersed into the atmosphere and chemical reactions leading to ozone formation take place.

Figure 2.5 shows the distribution of daily-based exceedances for the entire continent of Europe and the maximum temperatures observed in four European capital cities (Madrid, Paris, Prague and Rome). The distribution of exceedances per day and per country during summer 2008 is shown in Figure 2.6.

In summer 2008, the most severe ozone episode occurred from 17 June to 5 July. This period

Table 2.5 Overview of estimated percentage of area and population (9) resident in areas with ozone levels higher than the target value for the protection of human health during the summers of 2006–2008 on a country-by-country basis (only countries with spatial interpolation in Map 2.2 are shown) (10)

Country	Percentage of land area reporting exceedances of the Target Value			Percentage of the population affected by exceedances of the Target Value		
	2006	2007	2008	2006	2007	2008
Austria	98.9	98.0	12.1	93.0	89.1	4.2
Belgium	63.5	0.0	0.0	39.2	0.0	0.0
Switzerland	100.0	94.0	17.8	99.9	72.9	5.0
Czech Republic	100.0	96.0	30.0	99.9	73.9	20.4
Germany	84.0	46.3	19.4	83.1	26.0	10.5
Denmark	0.0	0.0	0.0	0.0	0.0	0.0
Estonia	0.0	0.0	0.0	0.0	0.0	0.0
Spain	82.6	42.2	33.6	42.7	20.7	15.5
Finland	0.0	0.0	0.0	0.0	0.0	0.0
France	47.9	24.4	10.3	36.1	18.7	6.8
United Kingdom	0.0	0.0	0.0	0.0	0.0	0.0
Hungary	97.5	99.9	69.0	73.6	98.5	45.8
Ireland	0.0	0.0	0.0	0.0	0.0	0.0
Iceland	0.0	0.0	0.0	0.0	0.0	0.0
Italy	87.9	74.4	46.0	66.7	66.3	48.6
Lithuania	0.0	0.0	0.0	0.0	0.0	0.0
Luxembourg	-	0.0	0.0	-	0.0	0.0
Latvia	0.0	0.0	0.0	0.0	0.0	0.0
Malta	13.0	0.0	0.0	2.6	0.0	0.0
Netherlands	11.6	0.0	0.0	11.2	0.0	0.0
Norway	0.0	0.0	0.0	0.0	0.0	0.0
Poland	75.8	25.7	2.8	58.4	25.2	2.1
Portugal	82.2	29.5	0.0	37.1	14.9	0.0
Sweden	0.0	0.0	0.0	0.0	0.0	0.0
Slovenia	99.5	99.0	70.8	97.4	93.5	43.4
Slovakia	97.1	100.0	69.9	88.2	100.0	50.5
Total	**45.2**	**28.2**	**14.2**	**48.3**	**28.2**	**13.1**

accounted for 40 % of the total number of exceedances of the information threshold experienced during the summer, 53 % of the exceedances of the alert threshold and 22 % of the exceedances of the long-term objective.

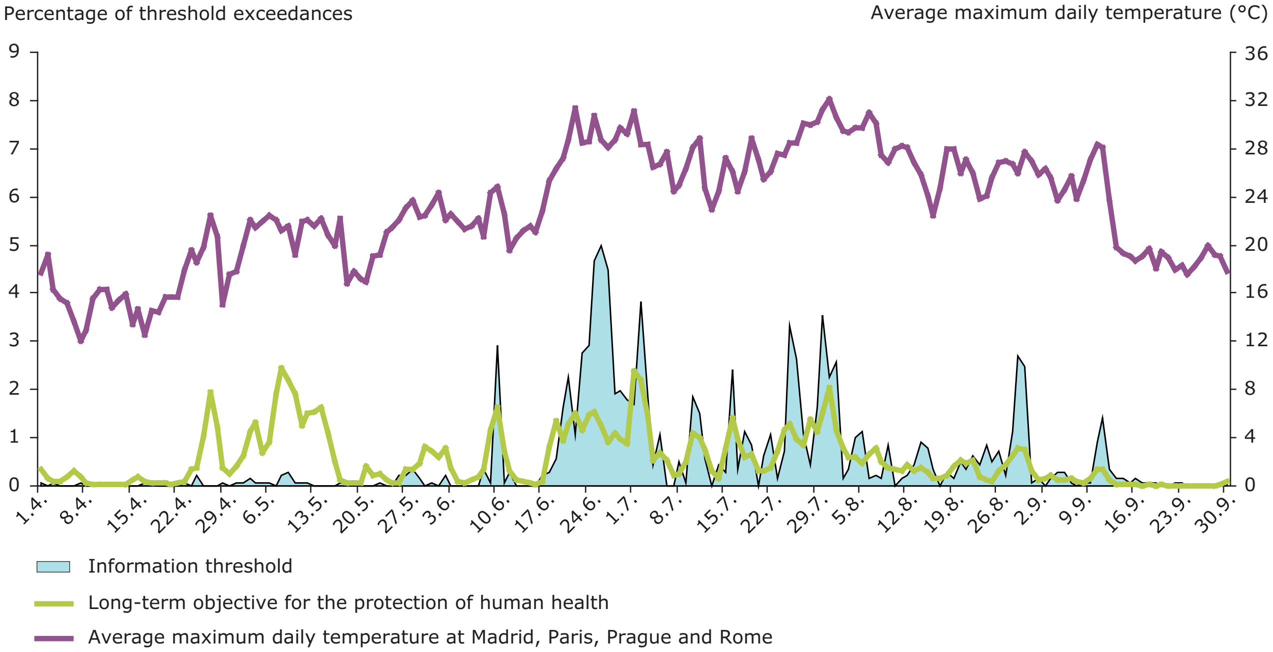
Areas with elevated ozone concentrations during this episode of summer 2008 were mostly located in northern and central Italy and the west Balkan countries. Unlike in previous years there was no distinct ozone episode over central or western Europe during the summer 2008.

Map 2.3 depicts the evolution of ozone concentrations and the meteorological situation on selected days during the ozone episode at the end of June 2008. The maps clearly show the coincidence of areas with elevated ozone concentrations and the areas with the highest temperatures.

(9) The Joint Research Centre (JRC) population dataset CLC2000 has been used to estimate the affected population (available at: http://dataservice.eionet.europa.eu/dataservice/metadetails.asp?id=830). The Oak Ridge National Laboratory (ORNL) Global Population Dataset, version 2002 (available at: http://www.ornl.gov/sci/landscan) has been used in areas not covered by the JRC dataset (i.e. Iceland, Norway and Switzerland). These datasets are incomparable in some respects but can be used together for the calculation of percentage of affected population because only the spatial distribution of the population is used.

(10) The data on affected area and population are indicative because the interpolation grid is 10 kilometres.

Figure 2.5 Distribution of exceedances during the summer of 2008 on a day-by-day basis

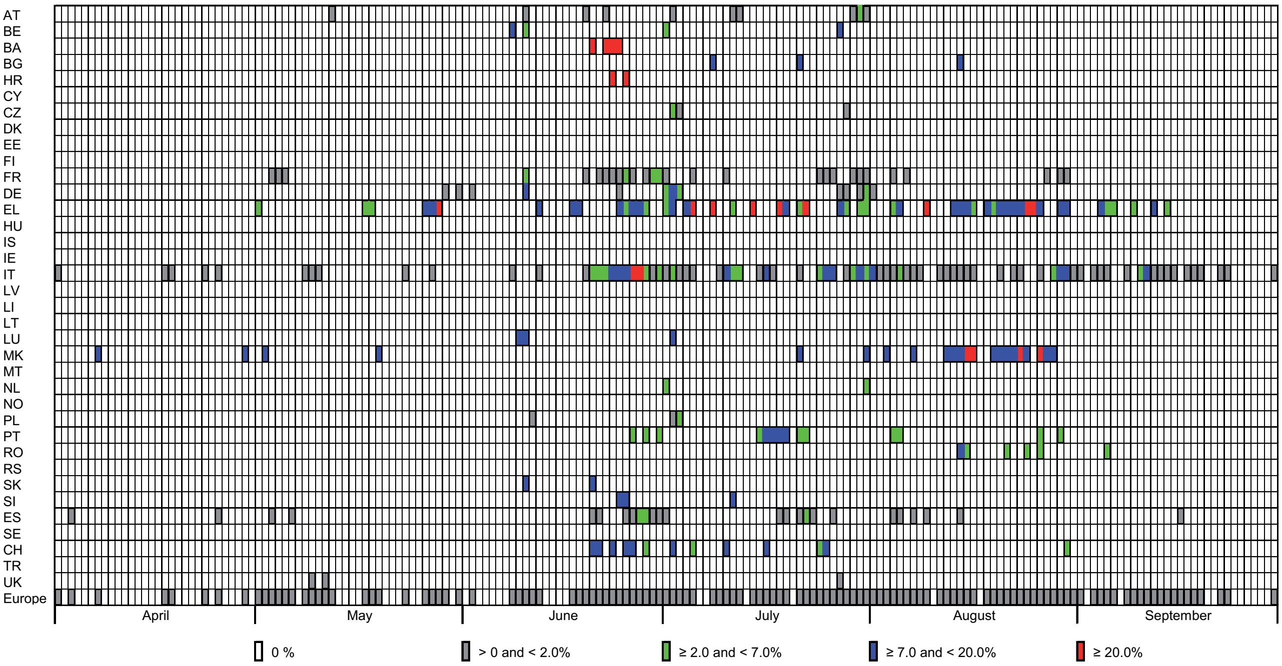


Note: The left y-axis represents the percentage of exceedances observed during a particular day. As such, the exceedances of the information threshold and the LTO depicted each total 100 % between 1 April and 30 September.

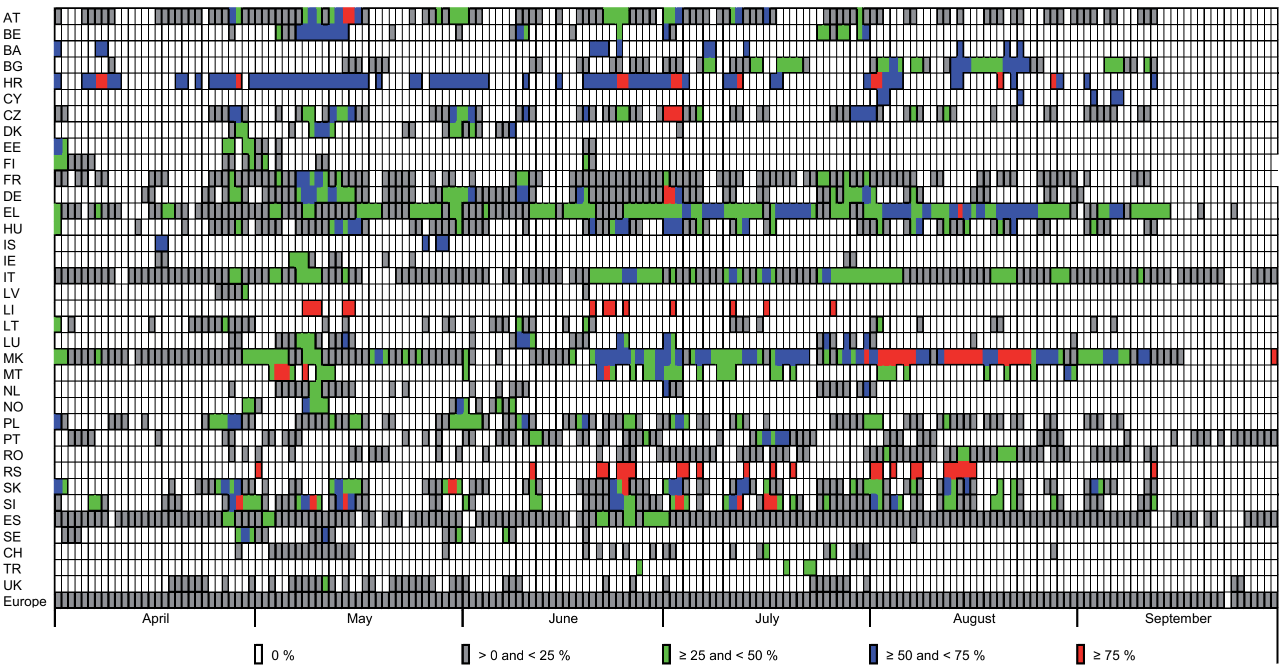
Source: EEA; http://www.wunderground.com (average maximum temperature data).

Figure 2.6 Distribution of exceedances during the summer of 2008: percentage of stations reporting exceedances on a daily basis per country

a) Information threshold exceedances

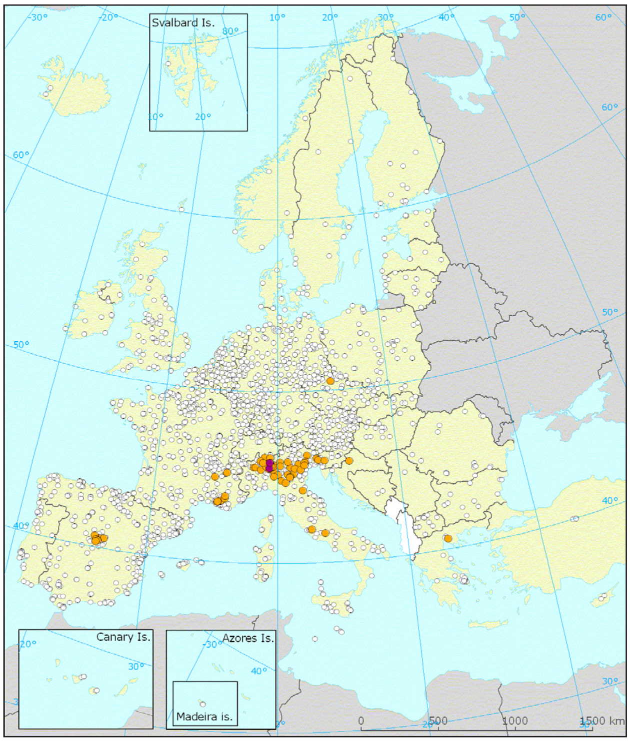


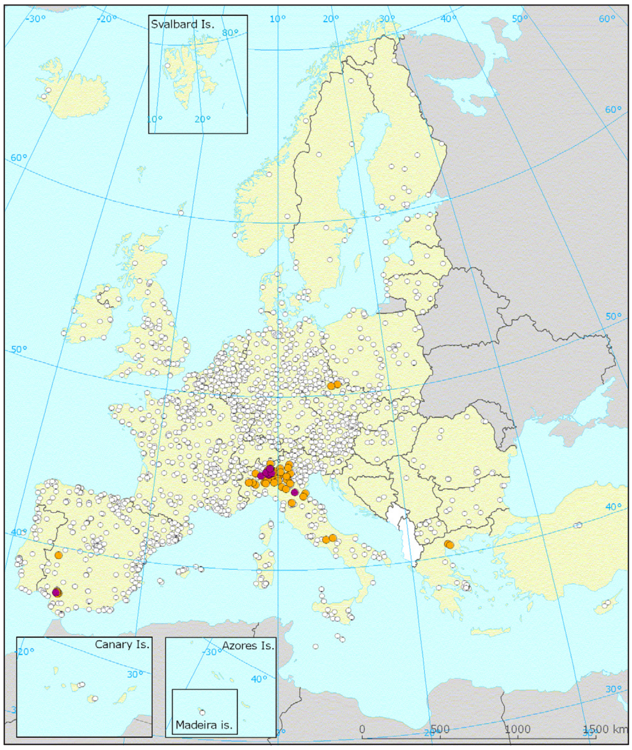
b) Long-term objective for the protection of human health exceedances



Note: The colours represent the percentage of a country's total number of stations that observe exceedances during a particular day.

Map 2.3 Selected days during the ozone episode at the end of June 2008: observed and modelled maximum 1-hour ozone concentrations





Maximal hourly value (µg.m⁻³) 25 June 2008

- ≤ 180 µg.m⁻³
- > 180 and ≤ 240 µg.m⁻³
- > 240 µg.m⁻³

Type of country

- Countries reporting data
- Countries with no data reported
- Non-EEA countries

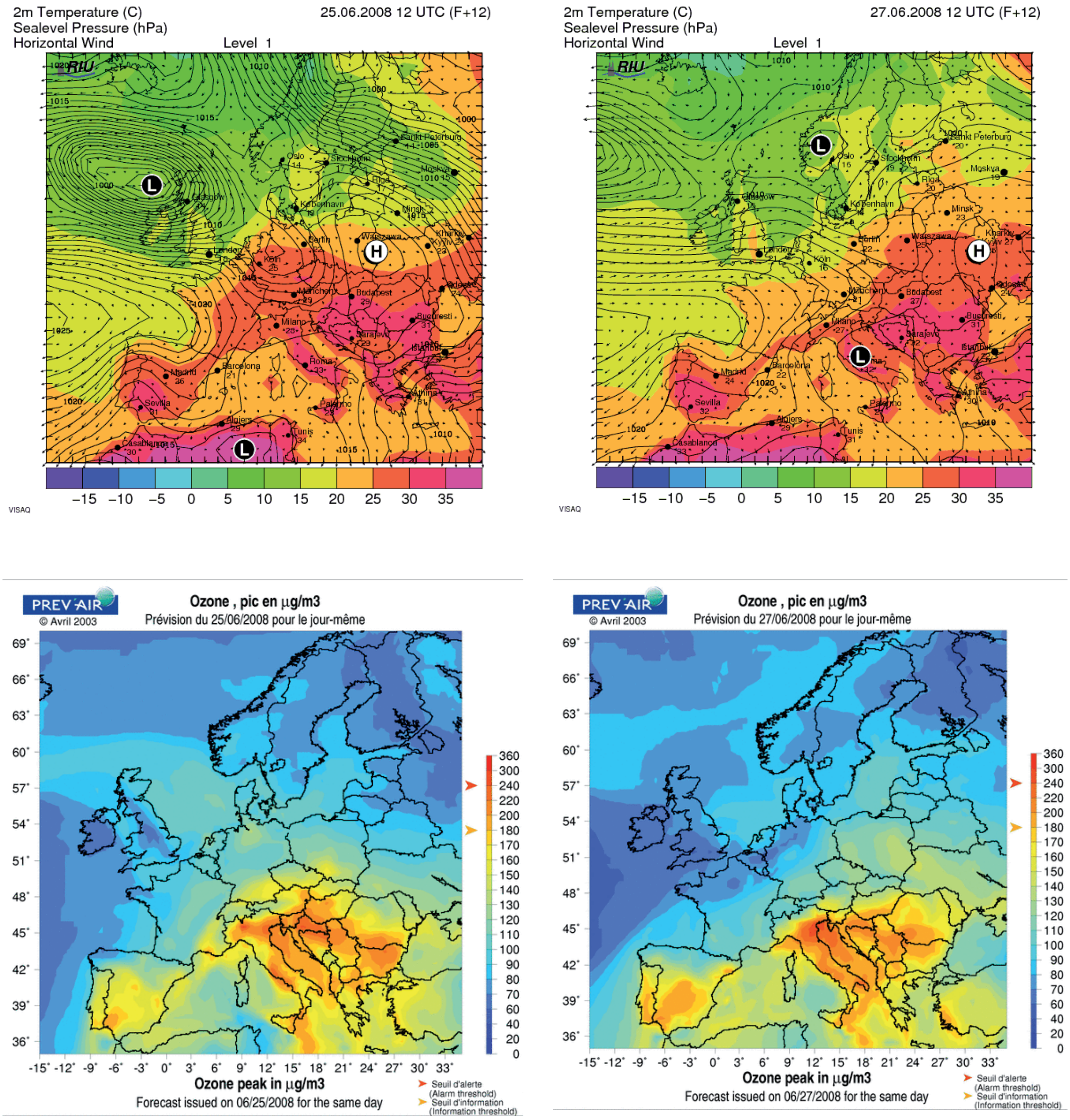
Maximal hourly value (µg.m⁻³) 27 June 2008

- ≤ 180 µg.m⁻³
- > 180 and ≤ 240 µg.m⁻³
- > 240 µg.m⁻³

Type of country

- Countries reporting data
- Countries with no data reported
- Non-EEA countries

Map 2.3 **Selected days during the ozone episode at the end of June 2008; observed and modelled maximum 1-hour ozone concentrations (contd)**



Source: EEA; Rhenish Institute for Environmental Research (ground level pressure, temperature and horizontal wind); PREV'AIR (modelled maximum 1-hour ozone concentration).

3 Comparison with previous years

Ozone levels in summer 2008 were compared with the summer ozone concentrations from 1997 to 2006 stored in the EEA air quality database 'AirBase', and the summer 2007 data submitted under Directive 92/72/EEC on air pollution by ozone. Only time series that included more than 75 % of valid, measured data during the summers of 1997–2006 were selected for comparison. Data stored in AirBase are validated, whereas the 2007 and 2008 summer data are provisional and only partly validated. Before 1997, ozone data collection in Europe was not comprehensive so the data in AirBase are not comparable. Even in the period since 1997 some of the observed changes may have been caused by changes in the location of stations and the density of the monitoring networks.

As described in previous chapters, ozone concentrations over Europe vary widely due to large differences in climate over the continent. To facilitate analysis of variations in ozone levels, Europe's monitoring stations were divided into four groups, defined based on broad climatic regions (see key for Figure 3.1).

The analysis clearly shows that exceedances occur frequently in the Mediterranean area. The number of occurrences in southern Europe was lower between 1999 and 2001 than in the extreme summer of 2003 (EEA, 2003) which saw a very large number of occurrences. This was also the case in more northern parts of Europe. While the situation during the summers of 2004 and 2005 returned to 'normal' (EEA, 2005; EEA, 2006) the summer of 2006 (EEA, 2007a) showed considerable differences in climatic conditions between northern Europe and other parts of the continent. No exceedances of the information threshold in northern Europe were significant in the hot summer of 2003, during which period maximum values were observed elsewhere in the continent. Ozone levels during the summer of 2007 and (in particular) summer 2008 rank among the lowest in the past decade (see Table 3.1 for detailed annual information).

At the current level of precursor emissions, the year-to-year differences in the occurrence of ozone threshold exceedances are induced substantially by meteorological variations (Solberg and Lindskog, 2005). Hot, dry summers with long-lasting periods of high air pressure over large parts of the European continent lead to elevated ozone concentrations and more exceedances of ozone threshold values; the hotter the summer, the higher the number of exceedances. This correspondence can also be demonstrated by charting the daily maximum temperatures averaged for the period April–September of a particular year observed in four capital cities in selected regions (Paris, Prague, Rome and Copenhagen) in relation to the number of exceedances (see Figure 3.1) .

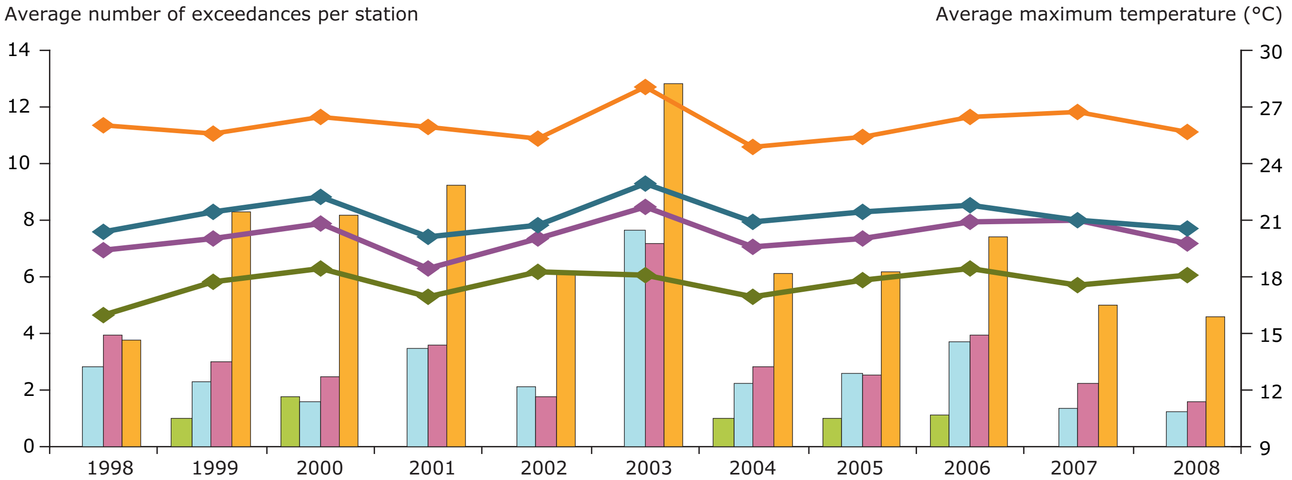
Emissions of ozone precursors, weighted according to their contribution in ozone formation (de Leeuw, 2002) have fallen over the period 1990–2005 by about 40 % in the EU-27. Over the periods 1996–2005 and 2001–2005 the decrease in total emissions was 25 % and 9 % respectively. Observed ozone concentrations during the last decade have not matched these emissions reductions.

Between the late 19th century and 1980, concentrations of background ozone in the mid-latitudes of the northern hemisphere doubled to about 60–75 $\mu g/m^3$ and have since increased to 80 $\mu g/m^3$. The cause of the increase in background ozone is not fully understood but is thought to be due mainly to increases in emissions in northern hemisphere countries, from poorly regulated sectors such as international shipping and aviation, and possibly also due to an increase in ozone from the stratosphere. Ozone can no longer be considered a local air quality issue — it is a global problem, requiring a global solution.

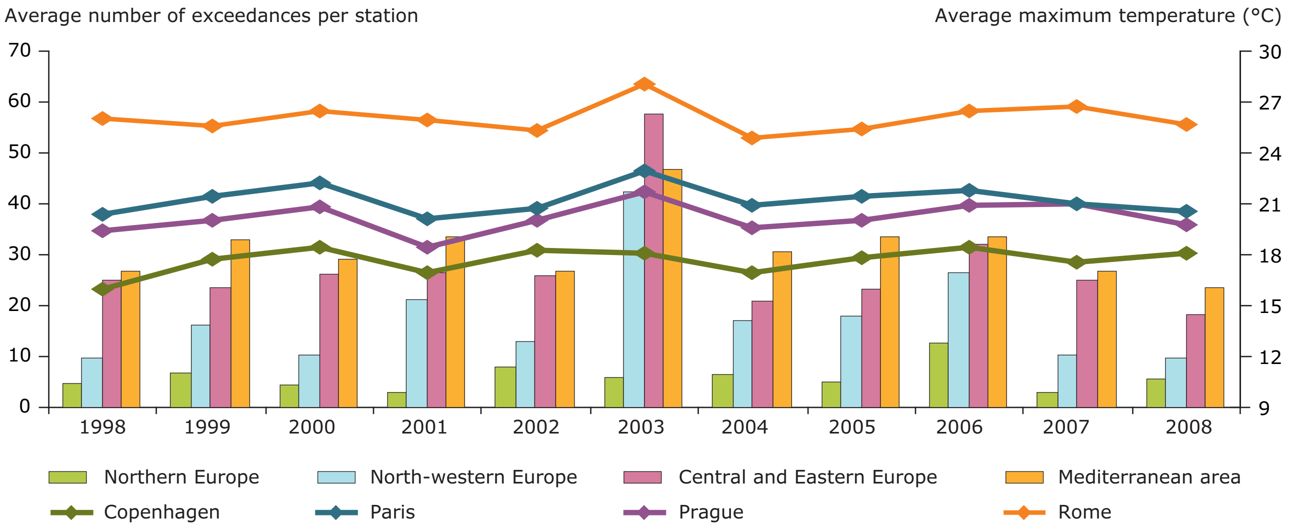
Setting aside the high concentrations in 2003, which were caused by the extremely favourable conditions for ozone formation in that year in most of Europe, the rural data show atmospheric ozone concentrations remaining unchanged. Data from the traffic and urban background stations suggest some increase. This increase can be explained by less ozone depletion due to decreasing nitrogen oxide emissions. The constant European background levels in rural areas are the net result of a number of possible processes: the increase in hemispheric background concentrations, less ozone deposition during the (more frequent) dry periods during summer, increased ozone formation due to higher temperatures, less

Figure 3.1 Regional average number of exceedances per station during the summer for stations that reported at least one exceedance and average maximum daily temperature in selected cities

a) Information threshold exceedances



b) Long-term objective for the protection of human health exceedances



Note: Northern Europe: Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, Sweden.
North-western Europe: Belgium, France (north of 45 ° latitude), Ireland, Luxembourg, the Netherlands, United Kingdom.
Central and eastern Europe: Austria, Bulgaria, Czech Republic, Germany, Hungary, Liechtenstein, Poland, Romania, Slovakia, Switzerland.
Mediterranean area: Albania, Andorra, Bosnia and Herzegovina, Croatia, Cyprus, France south of 45 ° latitude, Greece, Italy, Malta, Monaco, Montenegro, Portugal, San Marino, Serbia, Slovenia, Spain, the former Yugoslav Republic of Macedonia.

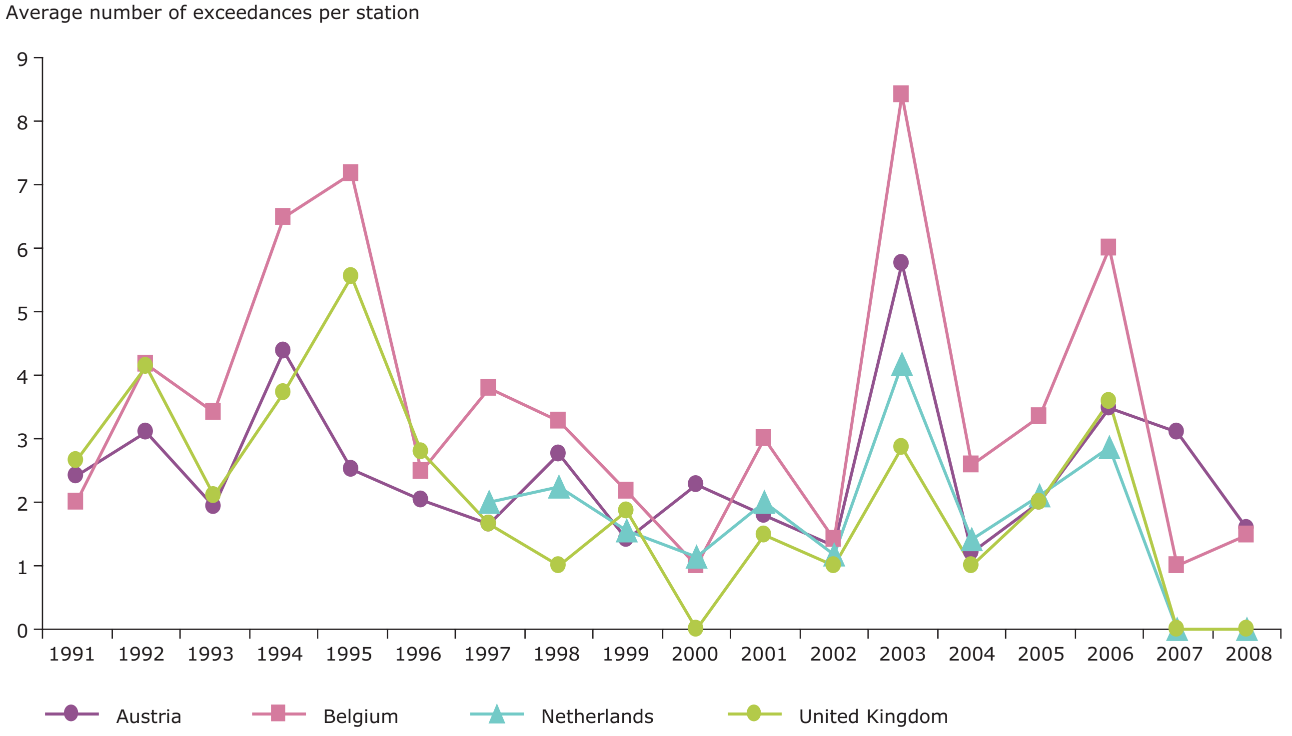
Source: EEA, http://www.wunderground.com (temperature data).

ozone formation due to emissions reduction. Climatologically, changes in large-scale circulation patterns over Europe might also play a role (EEA, 2007b; Mol *et al.*, 2008)

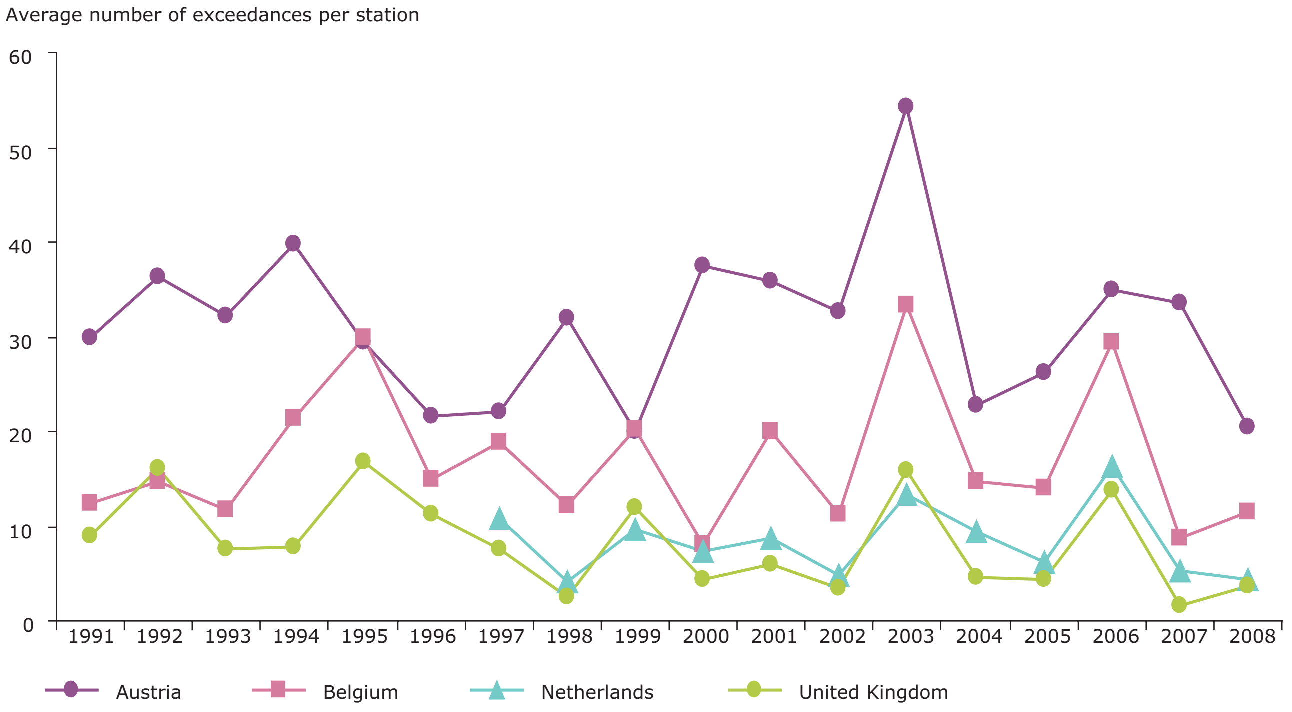
Figure 3.2 depicts the long-term trend in exceedances since 1990. The data for Figure 3.2 were provided by countries with data series of at least 15 years from several stations. The summers of 1990, 1994 and 1995 display the highest ozone levels, as well as summer 2003. The conspicuously higher numbers of LTO exceedances detected by Austria's stations more than 800 metres above sea level is also noteworthy.

Figure 3.2 Average number of exceedances per station during the summer for stations that reported at least one exceedance ([11]) (selected countries)

a) Information threshold exceedances



b) Long-term objective for the protection of human health exceedances



([11]) Only stations with data spanning at least 15 years were included.

Table 3.1 Overview of exceedances observed during the summer season in Europe in 1997–2008

a) Information threshold exceedances

Summer season	No. of stations ([a])	Stations with exceedance ([b])					No. of days with exceedance ([c])		Maximum observed one-hour concentration (μg/m³)	Occurrence of exceedances ([d])				Average duration of exceedances (hour)	
		(number)		(%)		(%)									
1997	819	344	16	42	2	5	123	18	315	1.2	2.8	0.0	1.3	2.7	1.7
1998	826	469	65	57	8	14	107	42	370	2.1	3.7	0.1	1.6	3.5	2.5
1999	1 202	405	47	34	4	12	161	97	829	1.5	4.5	0.1	3.8	3.2	3.7
2000	1 279	560	44	44	3	8	132	54	473	1.6	3.6	0.1	2.0	2.9	2.1
2001	1 444	702	89	49	6	13	147	82	470	2.6	5.4	0.2	2.6	3.1	2.0
2002	1 540	560	65	36	4	12	136	41	391	1.3	3.5	0.1	2.0	2.8	2.0
2003	1 639	1 203	318	73	19	26	171	88	418	6.6	9.0	0.5	2.4	3.9	2.2
2004	1 704	626	43	37	3	7	137	44	396	1.5	4.0	0.0	1.9	3.0	1.8
2005	1 839	849	68	46	4	8	163	61	457	1.8	4.0	0.1	2.1	3.2	2.3
2006	1 896	1 167	104	62	5	9	143	53	394	3.0	4.8	0.1	2.0	3.4	2.2
2007	2 062	551	54	27	3	10	144	35	479	0.9	3.5	0	1.8	3.1	1.9
2008	2 049	402	21	20	1	5	124	23	399	0.7	3.5	0	2.1	2.9	1.7

Notes: White columns refer to exceedances of the information threshold, grey ones to exceedances of the alert threshold.

([a]) Total number of stations measuring ozone levels.

([b]) The number and percentage of stations at which at least one threshold exceedance was observed; fifth column: percentage of stations with information threshold exceedance at which alert threshold exceedance were also observed.

([c]) The number of calendar days on which at least one exceedance of thresholds was observed.

([d]) Occurrence of exceedance is calculated as the average number of observed exceedances per station in a country. Left column: averaged over all implemented stations, right figure: averaged over all stations which reported at least one exceedance.

b) Long-term objective for the protection of human health exceedances

Summer season	No. of stations ([a])	Stations with LTO exceedance ([b]) (number)	(%)	Stations with TV exceedance ([b]) (number)	(%)	No. of days with LTO exceedance ([c])	Maximum observed 8-hour concentration (μg/m³)	Occurrence of LTO exceedances ([d])	
1997	819	748	91	216	26	183	252	18.9	20.7
1998	826	742	90	247	30	178	330	19.9	22.2
1999	1 202	1 109	92	360	30	183	537	20.8	22.6
2000	1 279	1 156	90	368	29	181	266	19.5	21.6
2001	1 444	1 320	91	561	39	183	320	24.0	26.3
2002	1 540	1 368	89	448	29	183	310	19.9	22.4
2003	1 639	1 557	95	1 103	67	183	297	45.0	47.4
2004	1 704	1 541	90	447	26	183	364	19.9	22.0
2005	1 839	1 671	91	622	34	183	334	22.6	24.9
2006	1 896	1 785	94	984	52	183	316	28.1	29.8
2007	2 049	1 691	83	563	27	183	275	17.9	21.6
2008	2 049	1 741	85	387	19	182	245	15.2	17.9

Notes: ([a]) Total number of stations measuring ozone levels.

([b]) The number and percentage of stations at which at least one exceedance was observed.

([c]) The number of calendar days on which at least one exceedance was observed.

([d]) Left column: averaged over all implemented stations, right figure: averaged over all stations which reported at least one exceedance.

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Annex 1 Legal requirements on data provision

Directive 2002/3/EC requires Member States to provide the following data to the European Commission and to the EEA:

Monthly data (Article 10(2)(a)(i))

For each month from April to September each year, data collected on exceedances of the information and/or the alert thresholds (one-hour ozone concentration higher than 180 µg/m^3 and 240 µg/m^3) must be reported before the end of the following month. Data submitted in the monthly reports are considered provisional and are updated, if necessary, in subsequent submissions.

Summer data (Article 10(2)(a)(ii))

Additional provisional data for the foregoing summer period (April–September), as defined in Annex III to the Directive (i.e. information on exceedances of alert and information thresholds, on exceedances of the health protection long-term objective, the daily maximum of 8-hour average ozone concentration higher than 120 µg/m^3, related NO_2 values when required and for each month one-hour maximum ozone concentrations) must be reported by 31 October.

Annual data (Article 10(2)(b))

Validated annual data for ozone and precursors (as defined in Annexes III and VI to the directive) of the previous year must be submitted by 30 September. The annual data flow is included in the questionnaire to be used for annual reporting on air quality assessment in the scheme of the Air Quality Framework Directive (96/62/EC) and its daughter directives — see Commission Decision 2004/461/EC for details (Commission of the European Communities, 2004).

Annex 2 Data reporting over summer 2008

To manage the monthly and summer data flows, the Member States are required to use a set of reporting forms as described in the guideline on Directive 2002/3/EC relating to ozone in ambient air: procedures and formats for the exchange (ETC/ACC, 2004).

Ozone monitoring stations operated throughout the whole period April–September 2008. It is possible, however, that some exceedances were not reported due to temporary maintenance work or malfunction. Nevertheless, experience with current, continuously operated ozone monitors shows that such situations occur rarely.

Countries reported information on the validity of one-hour measurements at 1 505 stations (equal to 73 % of all operational stations). Of those, 1 421 (94 %) provided valid one-hour measurements at least 75 % of the time (see Table A.1). The proportions were similar in summer 2007 (72 % and 95 %).

A summary of monthly reported data is presented and regularly updated on the ETC/ACC website: http://etc-acc.eionet.eu.int/databases/o3excess.

The ozone monitoring network in 2008

Map A.1 presents the location of all ozone-monitoring stations assumed to be operational in the reporting countries during summer 2008. In total, 2 049 ozone-monitoring sites were operational in summer 2008, out of which 1 998 were located in the EU.

The number of operational stations had previously increased gradually until 2006 but has stayed broadly unchanged since then (Table 3.1).

According to the requirements of the Directive 92/72/EEC on air pollution by ozone, stations should be situated away from the influence of local emissions. When looking at the delivered station meta-information, 433 (approximately 21 %) are traffic or industrial stations (thereby not fulfilling the requirements) but were included in 2008 summer reporting to match the practice in previous years.

Missing or unclear meta-information on monitoring stations was less of a problem than in previous years. Most of the countries transmitted complete information about all operational stations. To fill the gaps in station meta-information, i.e. geographical coordinates, information was extracted from AirBase. Nevertheless, for approximately 9 % of stations the type of station was not known.

Table A.1 Overview of the validity of one-hour measurements during the summer of 2008 on a country-by-country basis

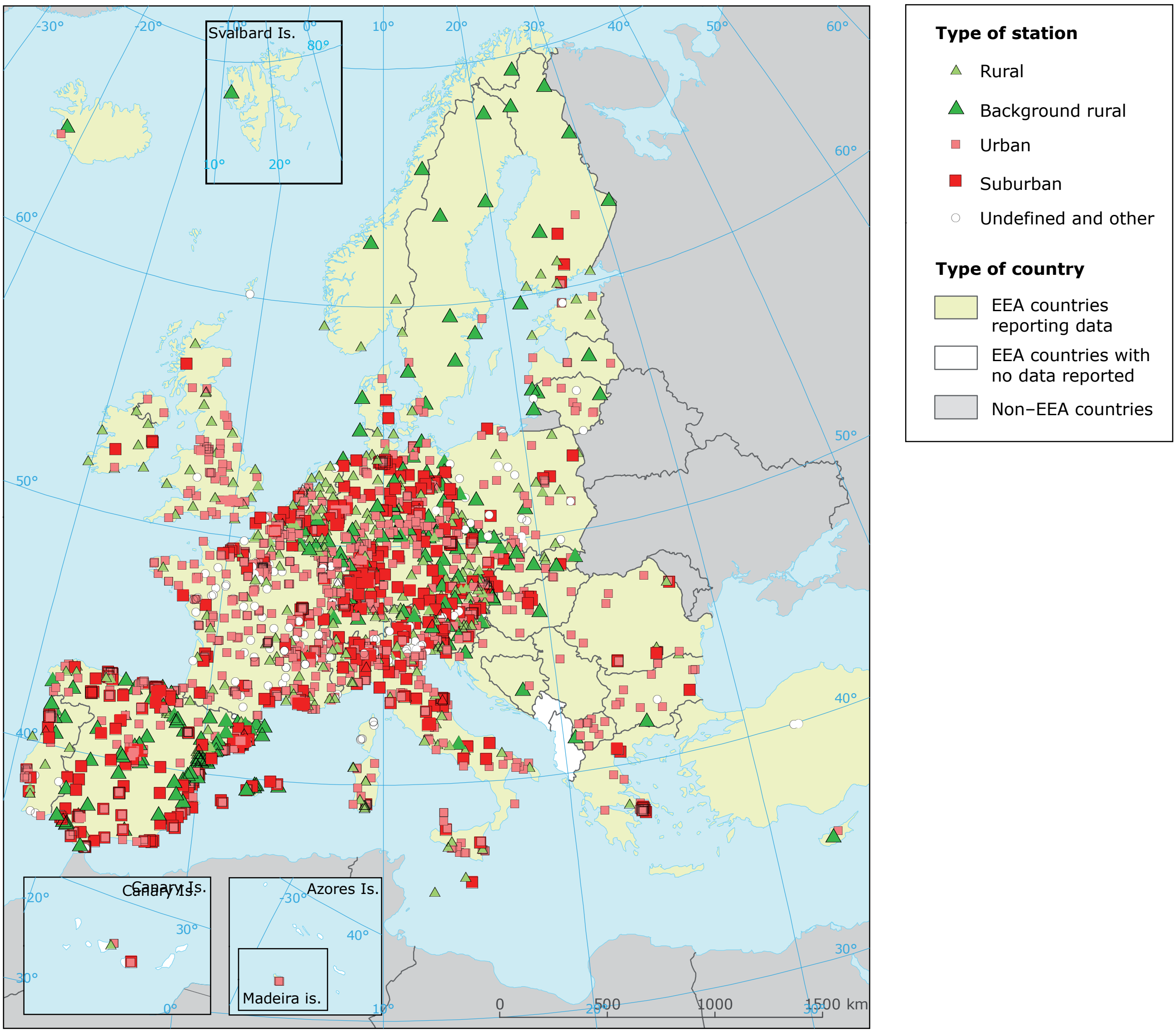
Country	Stations with available information (12) (%)	Stations with at least 75 % of valid one-hour data (13) (%)
Austria	100	100
Belgium	100	95
Bulgaria	100	100
Cyprus	100	100
Czech Republic	100	100
Denmark	100	100
Estonia	100	100
Finland	100	100
France	100	95
Germany	0	-
Greece	100	92
Hungary	100	100
Ireland	100	100
Italy	0	-
Latvia	100	100
Lithuania	100	92
Luxembourg	100	100
Malta	100	100
Netherlands	100	97
Poland	100	81
Portugal	100	98
Romania	100	65
Slovak Republic	100	100
Slovenia	100	92
Spain	100	94
Sweden	100	100
United Kingdom	100	96
Bosnia and Hercegovina	100	50
Croatia	100	100
Iceland	0	-
Liechtenstein	100	100
the former Yugoslav Republic of Macedonia	100	83
Norway	100	100
Serbia	100	100
Switzerland	100	100
Turkey	100	0
Total	**73**	**94**

Note: '-' indicates 'not applicable'.

(12) The percentage of stations for which the country provided information on the validity of one-hour measurements.

(13) The percentage of stations for which the country provided information, which provided valid one-hour measurements at least 75 % of the time during summer 2008.

Map A.1 **Location of ozone monitoring stations in summer 2008 as reported by Member States and other European countries**



Annex 3 Near real-time ozone data exchange

The information on ozone exceedances summarised in this report is provided through monthly reporting by Member States. This practice can be streamlined and updated by adopting near real-time data exchange of ozone data.

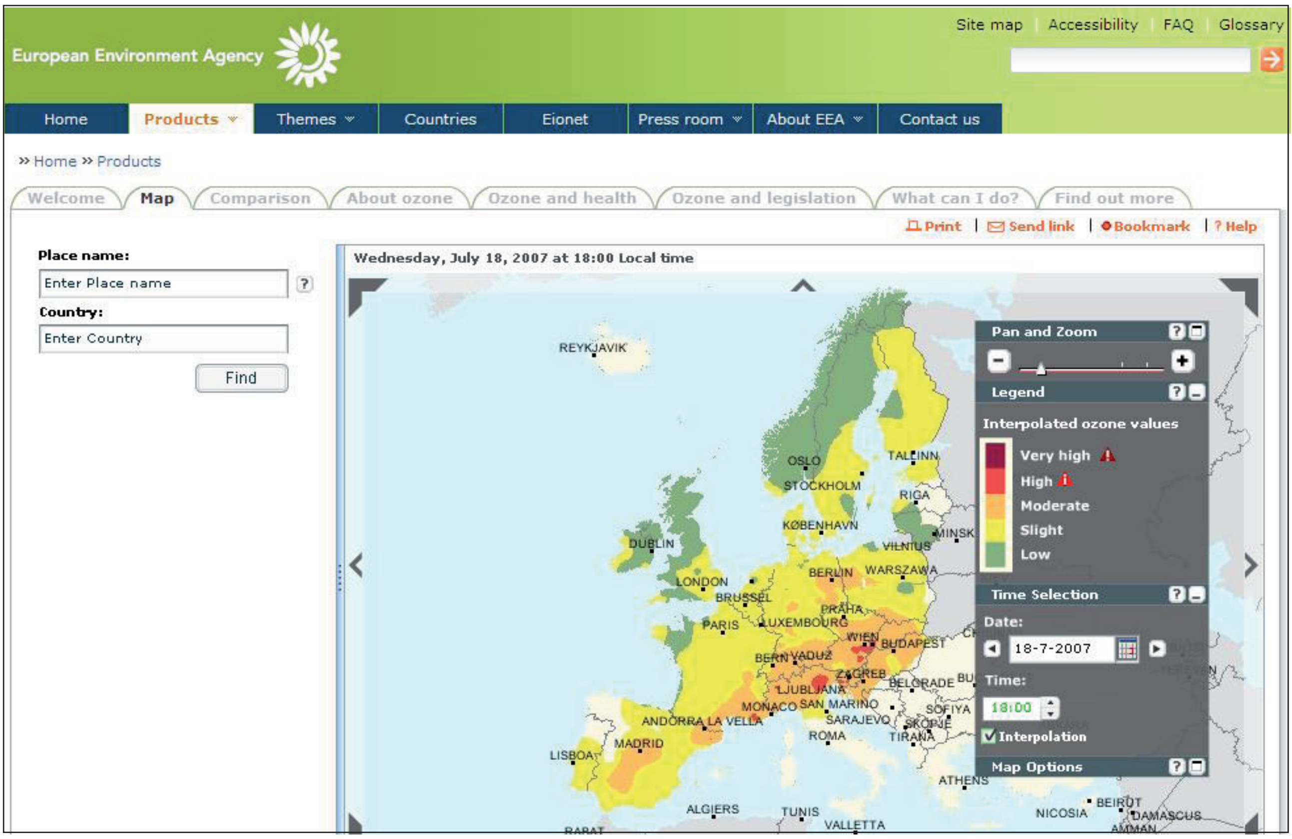
EEA has already established the Ozone Web, which is a pilot GIS-based system for collecting, providing and visualizing near real-time ambient ozone levels across Europe. Developed by the EEA as a joint European project, it provides up-to-date information in the form of maps and graphs, and background information on ozone and its health impacts.

Data from more than 700 air quality measurement stations across Europe are transmitted to the EEA in Copenhagen on an hourly basis. The information is provided by national and regional organisations in 20 countries on a voluntary basis and aims to serve the general public. Since the data must be as 'real-time' as possible, they are displayed as soon as possible after the end of each hour.

The air quality data used in the website are preliminary and may change when validated, so are not used for legal compliance reporting. Use restrictions may apply on some data.

In the Map A.2 below, the ozone level is illustrated by colours on the map. The colour scheme is linked to threshold values in EU legislation. A statistical calculation (interpolation) is carried out on the ozone data received by the EEA to provide an estimate of the ozone status in areas between measurement stations. Before the result of the

Map A.2 Screenshot of Ozone Web



calculation is shown on the map, a number of conditions have to be satisfied by the input data and the resulting calculation. These are that:

- 1 the number of stations is greater than 500 and the data are received from more than 80 % of the providers;
- 1 the density pattern of stations from which data are received is not significantly different to what is normally expected;
- 1 the root mean squared error value (RMSE) from a cross validation test carried out between 10 % of the data received and the result of the interpolation calculation is less than 20 μg/m^3.

Information on whether the real-time data service could replace the summer ozone report was presented at the twelfth and thirteenth EIONET Workshops on Air Quality Management and Assessment. Those presentations are available at:

- 1 http://air-climate.eionet.europa.eu/docs/meetings/071015_12th_EIONET_AQ_WS/14_NRT_O3_and_pot_SOR_Berkhout.pdf;
- 1 http://air-climate.eionet.europa.eu/docs/meetings/080929_13th_eionet_aq_ws/09_Cernikovky_SOR2008_13_EIONET_AQ_080929.pdf.

Further details and documents on the current progress of the EEA near real-time data exchange and the pilot to replace the summer ozone report are available at:

- 1 http://eea.eionet.europa.eu/Public/irc/eionet-circle/airclimate/library?l=/public/real-time_operational&vm=detailed&sb=Title.

European Environment Agency

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