

# Status report of air quality in Europe for year 2021, using validated data



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## 1 Summary

The *2021 Status report of air quality in Europe* presents summarized information on the status of air quality in Europe for the protection of health. It is based on 2021 validated monitoring data<sup>(1)</sup> officially reported under the Ambient Air Quality Directives in the 2022 September reporting cycle<sup>(2)</sup>. It provides information on the following pollutants, regulated by the Ambient Air Quality Directives (AAQD):

- PM<sub>10</sub>: Particulate matter with a diameter of 10 µm or less
- PM<sub>2.5</sub>: Particulate matter with a diameter of 2.5 µm or less
- O<sub>3</sub>: Tropospheric ozone
- NO<sub>2</sub>: Nitrogen dioxide
- BaP: Benzo[a]pyrene
- SO<sub>2</sub>: Sulphur dioxide
- CO: Carbon monoxide
- C<sub>6</sub>H<sub>6</sub>: Benzene
- As: Arsenic
- Cd: Cadmium
- Pb: Lead
- Ni: Nickel

It also offers a comparison with the situation in previous years.

Data included in this report was received by 13 February 2023 from the reporting countries. By that date the reporting status of 2021 validated data is summarized in Figure 1, where a green box indicates that the referred pollutant was reported by the referred country and a grey box indicates the contrary (that the referred pollutant was not reported by the referred country). Please see editorial notes at the end of this Chapter on additional information on the data used. The number of stations by country reporting each pollutant is also included in Figure 1, while Table 3 in the Annex summarizes the number of stations at different country aggregations. Data

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<sup>1</sup>Please be aware that some countries also report official data from modelling applications. Those data are available at <https://eeadmz1-cws-wp-air02.azurewebsites.net/index.php/users-corner/modeling-results-viewer/>

<sup>2</sup><https://aqportal.discomap.eea.europa.eu/index.php/reporters-corner/>

from stations that do not fulfil the criteria from Box 1.1 are excluded from this report. Please be aware that the number of stations presented in Figure 1 and Table 3 corresponds to all reported stations fulfilling the minimum data coverage criteria for annual mean. This number may be different to the one presented in the corresponding boxplots, as there could be some stations not fulfilling the minimum data coverage criteria for the corresponding aggregation.

Figure 1: Reporting status of 2021 air quality data by 13 February 2023

Albania												
Andorra	1	1	2	1		1	1					
Austria	122	61	105	143	28	65	27	20	11	12	11	11
Belgium	66	70	40	115	23	24	20	29	30	30	32	30
Bosnia and Herzegovina	15	11	9	14		21	3					
Bulgaria	37	6	19	24	15	26	17	20	7	12	11	7
Croatia	11	11	13	11	3	7	4	3	2	2	2	2
Cyprus	3	4	3	3	1	3	3	1	2	2	2	2
Czechia	145	87	64	95	51	59	21	39	56	56	56	56
Denmark	7	8	8	13	1	4	6	3	3	3	3	3
Estonia	7	7	9	9	5	9	7	4	5	5	5	5
Finland	41	22	17	39	10	14		2	5	5	2	5
France	356	188	302	380	52	91	12	57	50	50	50	49
Germany	382	272	275	638	105	109	87	104	102	102	102	102
Greece	23	11	20	21	1	10	10	8	2	2	2	2
Hungary	23	12	17	22	18	23	20	15	15	15	15	15
Iceland	6	4		7		11						
Ireland	39	34	17	22	5	10	4	2	5	5	5	5
Italy	561	307	347	620	164	225	204	236	142	141	136	134
Kosovo	12	12	10	11		8	11					
Latvia	5	4	7	8	5	6	1	6	5	5	5	5
Liechtenstein												
Lithuania	15	8	13	17	5	13	9	5	5	5	5	5
Luxembourg	6	4	5	85	2	3	3		2	2	2	2
Malta	3	4	4	4	1	3	2	2	3	3	3	3
Montenegro	4	4	1	4		4	4					
Netherlands	66	47	45	71	3	14	6	9	2	2	2	2
North Macedonia	12	11	15	7		14	16					
Norway	57	52	11	46	7	12	1	9	6	6	5	6
Poland	252	130	99	141	164	102	68	70	62	62	61	62
Portugal	39	20	41	45		25	10	6	1		1	1
Romania	123	26	71	144	4	145	129	100	44	57	59	51
Serbia	10	2	8	14		15	17		2	2	2	2
Slovakia	40	37	18	30	18	16	15	12	7	7	7	7
Slovenia	18	5	9	11	4	3		2	5	5	5	5
Spain	460	277	425	516	87	406	207	130	103	103	105	102
Sweden	62	40	34	93	3	23	5	11	4	4	3	4
Switzerland	29	7	29	31	9	7	8	3	11	12	12	11
Türkiye	203	98	117	156		193	86					
	PM10	PM2.5	O3	NO2	BaP	SO2	CO	C6H6	As	Cd	Pb	Ni

The countries included in this report and that, therefore, appear in Figure 1, are those with the obligation to report data under the AAQD or that have voluntary reported data. These countries are the EU-27 (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden); the five other member countries of the EEA (Iceland, Liechtenstein, Norway, Switzerland and Türkiye) that, together with the EU-27 form the EEA-32; the six EEA’s cooperating countries from the Western Balkans (Albania, Bosnia and Herzegovina, Kosovo under UN Security Council Resolution

1244/99, Montenegro, North Macedonia and Serbia) that, together with the EEA-32 form the EEA-38; and the voluntary reporting country of Andorra.

The air quality data are stored at the EEA's e-reporting database <sup>(3)</sup>. Therefore, this is the source for all maps and figures in the report.

## 1.1 Particulate matter

For PM<sub>10</sub>, concentrations above the EU daily limit value (50 µg/m<sup>3</sup>) were registered at 15 % of the reporting stations. These stations were in 15 countries in EU-27 and in 6 other reporting countries. For PM<sub>2.5</sub>, concentrations above the EU annual limit value (25 µg/m<sup>3</sup>) were registered at 2 % of the reporting stations. These stations were in 4 countries in EU-27 and in 4 other reporting countries.

The long-term World Health Organization air quality guideline (WHO AQG) level for PM<sub>10</sub> (15 µg/m<sup>3</sup>) was exceeded at 71 % of the stations in 27 countries of the EU-27 and 9 other reporting countries. The long-term WHO AQG level for PM<sub>2.5</sub> (5 µg/m<sup>3</sup>) was exceeded at 95 % of the stations located in 27 countries of the EU-27 and 10 other reporting countries.

All Member States had met the exposure concentration obligation that was set under the Ambient Air Quality Directive to be attained as of 2015. The exposure concentration obligation reflects exposure of the population to fine particles and required that by 2015 exposure of the general population to PM<sub>2.5</sub> averaged over the previous 3-year period should not exceed 20 µg/m<sup>3</sup>. However, the national exposure reduction target was met for all reporting countries except one.

## 1.2 Ozone

12 % of stations registered concentrations above the EU target value for O<sub>3</sub> (120 µg/m<sup>3</sup>) for the protection of human health. These stations were located in 16 countries of the EU-27 and 6 other reporting countries. The long-term EU objective (120 µg/m<sup>3</sup>) was met in only 21 % of the stations. The short-term WHO AQG level for O<sub>3</sub> (100 µg/m<sup>3</sup>) was exceeded in 90 % of all the reporting stations, and concentrations above the long-term WHO AQG level for O<sub>3</sub> (60 µg/m<sup>3</sup>) were registered in 97 % of all reporting stations.

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<sup>3</sup><https://discomap.eea.europa.eu/map/fme/AirQualityExport.htm>

### 1.3 Nitrogen dioxide

Around 3 % of all the reporting stations recorded concentrations above the EU annual limit value for NO<sub>2</sub> (40 µg/m<sup>3</sup>). These stations were located in 9 countries of the EU-27 and 2 other reporting countries. 75 % of concentrations above this limit value were observed at traffic stations.

On the contrary, 75 % of stations, located in 27 countries of the EU-27 and 10 other reporting countries reported concentrations above the WHO AQG level of 10 µg/m<sup>3</sup>.

### 1.4 Benzo[a]pyrene, an indicator for polycyclic aromatic hydrocarbons

27 % of the stations reported annual mean concentrations above 1.0 ng/m<sup>3</sup>. They were located in 12 countries in EU-27 and 1 other reporting countries.

### 1.5 Sulphur dioxide, carbon monoxide, benzene and toxic metals

For SO<sub>2</sub>, concentrations above the EU daily limit value (125 µg/m<sup>3</sup>) were registered at 1 % of the reporting stations. These stations were in 1 country of the EU-27 and 4 other reporting countries. However, 6 % of all reporting SO<sub>2</sub> stations measured SO<sub>2</sub> concentrations above the daily WHO AQG level (40 µg/m<sup>3</sup>). These stations were located in 12 countries of the EU-27 and 7 other reporting countries.

The EU limit value for CO (10 mg/m<sup>3</sup>), which is the same as the 8-hour WHO AQG level, was exceeded at 0.4 % of the stations. These stations were in 1 country of the EU-27 and 2 other reporting countries.

Concentrations above the EU limit value for C<sub>6</sub>H<sub>6</sub> (5 µg/m<sup>3</sup>) were observed at only 0.1 % of the stations. This station was located in 1 country of the EU-27.

1 % of stations registered concentrations above the EU target value for As (6 ng/m<sup>3</sup>). These stations were located in 3 countries of the EU-27 and 0 other reporting countries. For Cd, concentrations above the EU target value (5 ng/m<sup>3</sup>) were registered at 0.1 % of the stations located in 1 countries of the EU-27 and 0 other reporting countries. The EU target value for Ni (20 ng/m<sup>3</sup>) was exceeded at 0.4 % of the stations. These stations were located in 2 countries of the EU-27 and 1 other reporting countries. Pb concentrations above the limit value (0.5 µg/m<sup>3</sup>) were measured at 0.1 % of the stations located in 1 countries of the EU-27 and 0 other reporting countries.



## 1.6 Editorial note

Values in Table 4 in the Annex are considered outliers and were not taken into account for the analysis presented in this report.

The ozone concentration for the only station from Montenegro, ME0009A Niksic2, has not been included as it seems to have been reported with wrong units.

## 2 Introduction

The *2021 Status report of air quality in Europe* presents summarized information on the air quality data reported as measurements data under the 2022 September reporting cycle (validated assessment data for 2021, deadline of submission 30 September 2022). This report aims at informing on the 2021 status of ambient air quality in Europe and on progress towards meeting the air quality standards established for the protection of health in the Ambient Air Quality Directives (EU, 2004, 2008) (Table 1) and the World Health Organization air quality guideline levels (WHO, 2000, 2006, 2021) (Table 2)<sup>(4)</sup>.

This report builds on the former EEA “Air quality in Europe report” (EEA, 2020) content, figures and maps regarding the status of monitored air quality in Europe. It provides:

- a European overview of the 2021 monitoring stations reported, and of their concentrations in relation to the EU legal standards and WHO AQG levels for each pollutant;
- a map with the 2021 concentrations at station level for each pollutant;
- a boxplot graph summarizing for each country the range of concentrations (highlighting the lowest, highest, average and the 25 and 75 percentiles) for PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, O<sub>3</sub> and BaP.

Furthermore, it provides:

- maps with the situation at station level for the previous three years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed;
- heatmaps with the evolution of the mean and the maximum measured concentrations at country level since 2000 (or since when available).

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<sup>4</sup>Nevertheless, in this report the following standards and guideline levels are not analysed: information and alert thresholds for O<sub>3</sub>, alert threshold for NO<sub>2</sub>, and alert threshold for SO<sub>2</sub> in Table 1; and hourly air quality guideline level for NO<sub>2</sub>, 10 minutes air quality guideline level for SO<sub>2</sub>, and hourly air quality guideline level for CO in Table 2.

Table 1: Air quality standards for the protection of health, as given in the EU Ambient Air Quality Directives

Pollutant	Averaging period	Legal nature and concentration	Comments
PM <sub>10</sub>	1 day	Limit value: 50 µg/m <sup>3</sup>	Not to be exceeded on more than 35 days per year
	Calendar year	Limit value: 40 µg/m <sup>3</sup>	
PM <sub>2.5</sub>	Calendar year	Limit value: 25 µg/m <sup>3</sup>	Stage 1
		Indicative limit value: 20 µg/m <sup>3</sup>	Stage 2: indicative limit value to be reviewed by the Commission in 2013. It remained unchanged after that revision
		Exposure concentration obligation: 20 µg/m <sup>3</sup>	Average Exposure Indicator (AEI) <sup>(a)</sup> in 2015 (2013-2015 average)
		National Exposure reduction target: 0-20 percentage reduction in exposure	AEI <sup>(a)</sup> in 2020, the percentage reduction depends on the initial AEI
O <sub>3</sub>	Maximum daily 8-hour mean	Target value: 120 µg/m <sup>3</sup>	Not to be exceeded on more than 25 days/year, averaged over 3 years <sup>(b)</sup>
		Long term objective: 120 µg/m <sup>3</sup>	
	1 hour	Information threshold: 180 µg/m <sup>3</sup> Alert threshold: 240 µg/m <sup>3</sup>	
NO <sub>2</sub>	1 hour	Limit value: 200 µg/m <sup>3</sup>	Not to be exceeded on more than 18 hours per year
		Alert threshold: 400 µg/m <sup>3</sup>	To be measured over 3 consecutive hours over 100 km <sup>2</sup> or an entire zone
	Calendar year	Limit value: 40 µg/m <sup>3</sup>	
BaP	Calendar year	Target value: 1 ng/m <sup>3</sup>	Measured as content in PM <sub>10</sub>
SO <sub>2</sub>	1 hour	Limit value: 350 µg/m <sup>3</sup>	Not to be exceeded on more than 24 hours per year
		Alert threshold: 500 µg/m <sup>3</sup>	To be measured over 3 consecutive hours over 100 km <sup>2</sup> or an entire zone
	1 day	Limit value: 125 µg/m <sup>3</sup>	Not to be exceeded on more than 3 days per year
CO	Maximum daily 8-hour mean	Limit value: 10 mg/m <sup>3</sup>	
C <sub>6</sub> H <sub>6</sub>	Calendar year	Limit value: 5 µg/m <sup>3</sup>	
Pb	Calendar year	Limit value: 0.5 µg/m <sup>3</sup>	Measured as content in PM <sub>10</sub>
As	Calendar year	Target value: 6 ng/m <sup>3</sup>	Measured as content in PM <sub>10</sub>
Cd	Calendar year	Target value: 5 ng/m <sup>3</sup>	Measured as content in PM <sub>10</sub>
Ni	Calendar year	Target value: 20 ng/m <sup>3</sup>	Measured as content in PM <sub>10</sub>

**Notes:**

<sup>a</sup> AEI: based upon measurements in urban background locations established for this purpose by the Member States, assessed as a 3-year running annual mean.

<sup>b</sup> In the context of this report, only the maximum daily 8-hour means in 2021 are considered, so no average over the period 2019 - 2021 is presented.

**Sources:**

EU (2004, 2008).

Table 2: WHO air quality guideline (AQG) levels and estimated reference levels (RL) <sup>(a)</sup>

Pollutant	Averaging period	AQG	RL	Comments
PM <sub>10</sub>	1 day	45 µg/m <sup>3</sup>		99th percentile (3-4 exceedance days per year). Updated 2021 guideline
	Calendar year	15 µg/m <sup>3</sup>		Updated 2021 guideline
PM <sub>2.5</sub>	1 day	15 µg/m <sup>3</sup>		99th percentile (3-4 exceedance days per year). Updated 2021 guideline
	Calendar year	5 µg/m <sup>3</sup>		Updated 2021 guideline
O <sub>3</sub>	Maximum daily 8-hour mean	100 µg/m <sup>3</sup>		99th percentile (3-4 exceedance days per year). Updated 2021 guideline
	Peak season <sup>(b)</sup>	60 µg/m <sup>3</sup>		New 2021 guideline
NO <sub>2</sub>	1 hour	200 µg/m <sup>3</sup>		
	1 day	25 µg/m <sup>3</sup>		99th percentile (3-4 exceedance days per year). New 2021 guideline
	Calendar year	10 µg/m <sup>3</sup>		Updated 2021 guideline
BaP	Calendar year		0.12 ng/m <sup>3</sup>	
SO <sub>2</sub>	10 minutes	500 µg/m <sup>3</sup>		
	1 day	40 µg/m <sup>3</sup>		99th percentile (3-4 exceedance days per year). Updated 2021 guideline
CO	1 hour	30 mg/m <sup>3</sup>		
	Maximum daily 8-hour mean	10 mg/m <sup>3</sup>		
	1 day	4 mg/m <sup>3</sup>		99th percentile (3-4 exceedance days per year). New 2021 guideline
C <sub>6</sub> H <sub>6</sub>	Calendar year		1.7 µg/m <sup>3</sup>	
Pb	Calendar year	0.5 µg/m <sup>3</sup>		
As	Calendar year		6.6 ng/m <sup>3</sup>	
Cd	Calendar year	5 ng/m <sup>3</sup> <sup>(c)</sup>		
Ni	Calendar year		25 ng/m <sup>3</sup>	

**Notes:**

<sup>a</sup> As WHO has not set an AQG level for BaP, C<sub>6</sub>H<sub>6</sub>, As and Ni, the RL was estimated assuming an acceptable risk of additional lifetime cancer risk of approximately 1 in 100 000.

<sup>b</sup> Average of daily maximum 8-hour mean concentration in the six consecutive months with the highest six-month running average O<sub>3</sub> concentration.

<sup>c</sup> AQG set to prevent any further increase of Cd in agricultural soil, likely to increase the dietary intake of future generations.

**Sources:**

WHO (2000, 2006, 2021).

### Box 1.1 Classification of monitoring stations and criteria used for the assessment

Fixed sampling points in Europe are situated at different types of stations following rules for macro- and micro-scale siting. Briefly, depending on the predominant emission sources, stations are classified as follows:

- traffic stations: located in close proximity to a single major road;
- industrial stations: located in close proximity to an industrial area or an industrial source;
- background stations: where pollution levels are representative of the average exposure of the general population or vegetation.

Depending on the distribution/density of buildings, the area surrounding the station is classified as follows:

- urban: continuously built-up urban area;
- suburban: largely built-up urban area;
- rural: all other areas.

In general, for the pollutants considered in this report, monitoring stations have to fulfil the criterion of reporting more than 75 % of valid data out of all the possible data in a year to be included in this assessment. The Ambient Air Quality Directive sets, for compliance purposes, the objective of a minimum data capture of 90 % for monitoring stations, but, for assessment purposes, a coverage of 75 % allows more stations to be taken into account without a significant increase in monitoring uncertainties. For benzene, As, Cd, Ni and BaP, the general amount of valid data is 13% (according to the air quality objectives for indicative measurements). The exceptions to the general rule are PM and lead random fixed measurements, for which the required amount of valid data for the analysis is 13 %. Reporting stations not fulfilling the minimum data coverage could be found at the [Annual AQ statistics table](#).

Measurement data are rounded following the general recommendations under (EU, 2011). The number of considered decimals are indicated in the legend of the corresponding maps.

The assessments, in the cases of PM and SO<sub>2</sub>, do not account for the fact that the Ambient Air Quality Directive (EU, 2008) provides Member States with the possibility of subtracting contributions to the measured concentrations from natural sources and winter road sanding/salting under specific circumstances.

## 3 Status of particulate matter ambient air concentrations

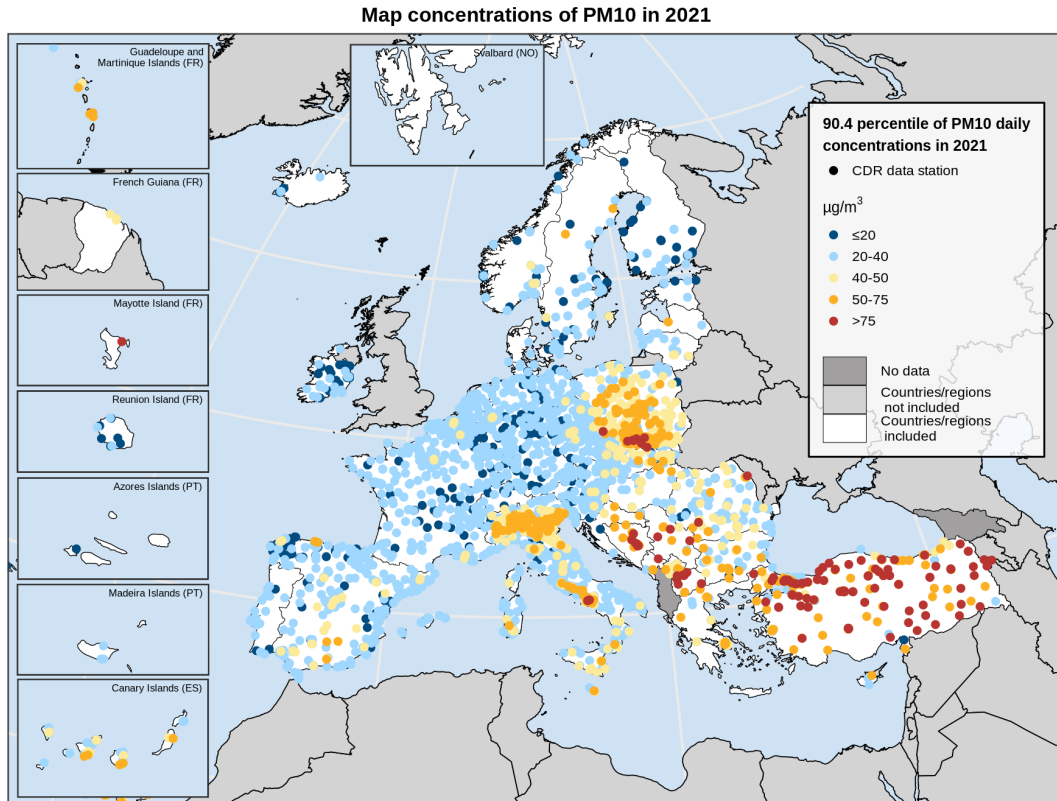
### 3.1 Status of PM<sub>10</sub> concentrations

The EEA received PM<sub>10</sub> data for 2021, with sufficient valid measurements (a general minimum coverage of 75 % and of 13 % for fixed random measurements) from 3260 stations for the calculation of annual mean concentrations and from 3250 stations in relation to the daily limit value. The stations were located in all the reporting countries shown in Figure 1.

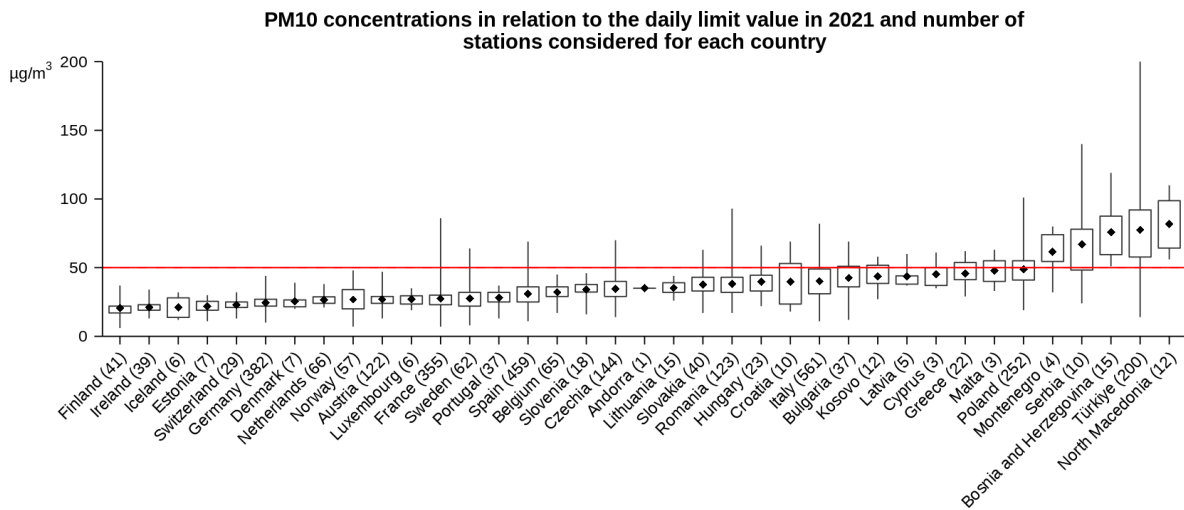
Fifteen countries in EU-27, and six other reporting countries reported PM<sub>10</sub> concentrations above the EU daily limit value of 50 µg/m<sup>3</sup> (Figure 2). This was the case for 15 % (491) of reporting stations. In total, 96 % of those stations were either urban (86 %) or suburban (10 %). The stricter value of the WHO AQG level for PM<sub>10</sub> daily mean (45 µg/m<sup>3</sup>) was exceeded at 71 % (2312) of the stations in all the reporting countries (Figure 8).

Concentrations above the PM<sub>10</sub> annual limit value (40 µg/m<sup>3</sup>) were monitored in 4 % (146 stations) of all the reporting stations, located in 6 countries in EU-27, and 5 other reporting countries. The stricter value of the WHO AQG level for PM<sub>10</sub> annual mean (15 µg/m<sup>3</sup>) was exceeded at 71 % (2315) of the stations in all the reporting countries (Figure 5).

Figure 2: Map and boxplot of PM<sub>10</sub> concentrations in 2021 - daily limit value



Note: Observed concentrations of PM<sub>10</sub> in 2021. The possibility of subtracting contributions to the measured concentrations from natural sources and winter road sanding/salting has not been considered. The map shows the 90.4 percentile of the PM<sub>10</sub> daily mean concentrations, representing the 36th highest value in a complete series. It is related to the PM<sub>10</sub> daily limit value, allowing 35 exceedances of the 50 µg/m<sup>3</sup> threshold over 1 year. The last two colour categories indicate stations with concentrations above this daily limit value. Only stations with more than 75 % of valid data, and more than 13 % in the case of fixed random measurements, have been included in the map.

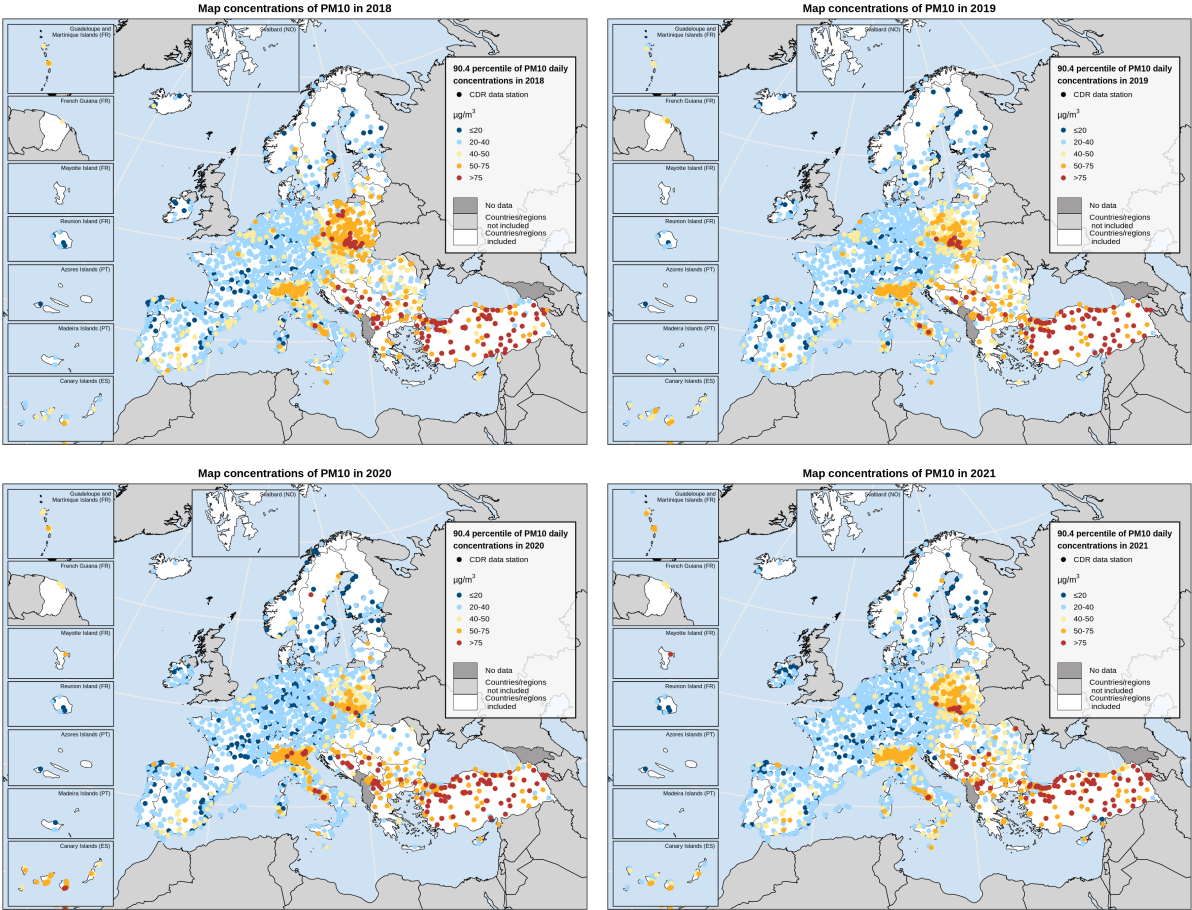


Note: The graph is based, for each country, on the 90.4 percentile of daily mean concentration values corresponding to the 36th highest daily mean in a complete time series. For each country, the number of stations considered for 2021 (in brackets) are given. The boxplot represents the lowest (bottom of the whisker), highest (top of the whisker) and average (black dot) 90.4 percentile values (in µg/m<sup>3</sup>). The rectangles mark the 25th and 75th percentiles. At 25 % of the stations, levels are below the 25th percentile; at 25 % of the stations, concentrations are above the 75th percentile. The daily limit value set by EU legislation is marked by the horizontal line. The graph should be read in relation to the above map, as a country's situation depends on the number of stations considered.

The highest value in the boxplot, Türkiye (246 µg/m<sup>3</sup>), has not been included in the graph for representation purposes.

Figure 3 shows the maps of the 90.4 percentile of PM<sub>10</sub> daily mean concentrations (equivalent to the PM<sub>10</sub> daily limit value) for four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data on the central data repository (CDR).

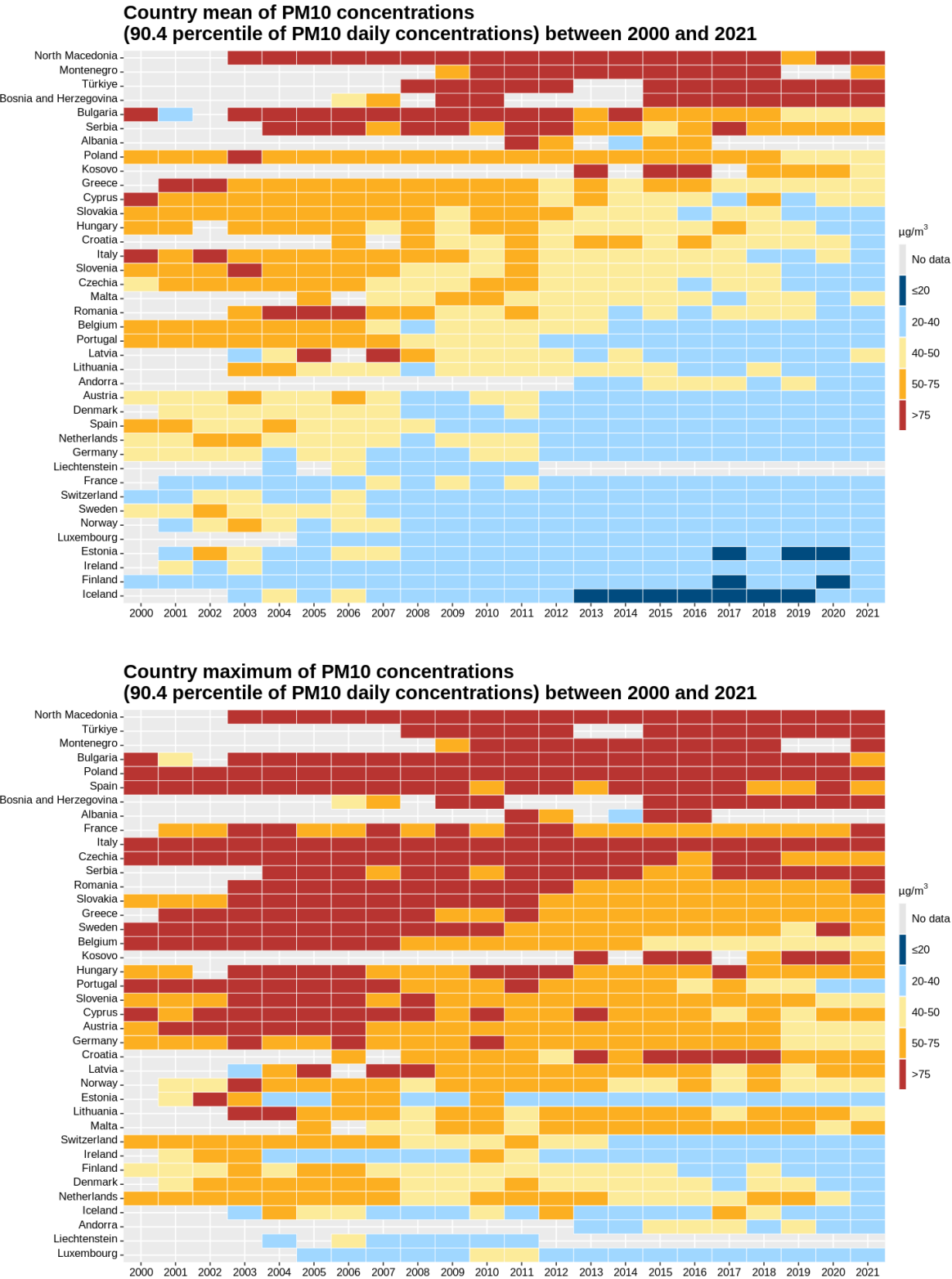
Figure 3: Maps of PM<sub>10</sub> concentrations (daily limit value) for the last 4 years



Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) 90.4 percentile of PM<sub>10</sub> daily mean concentrations at country level are shown in figure 4. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

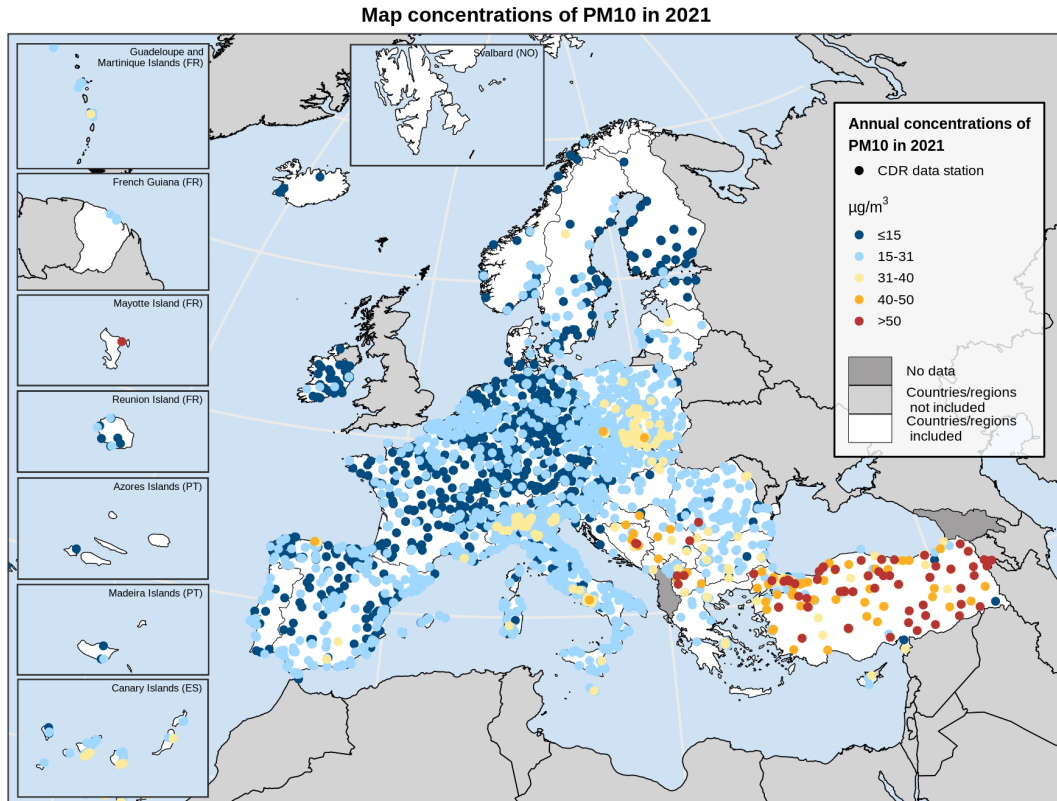


Figure 4: Evolution of mean (top) and maximum (bottom) 90.4 percentile of PM<sub>10</sub> daily mean concentrations (daily limit value) per country from 2000

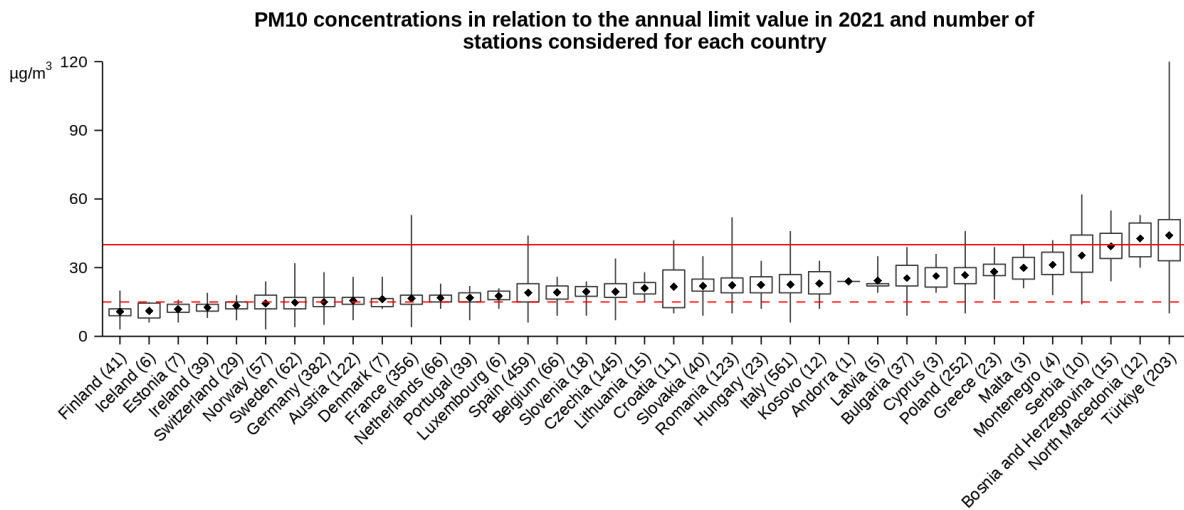


Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

Figure 5: Map and boxplot of PM<sub>10</sub> concentrations in 2021 - annual limit value



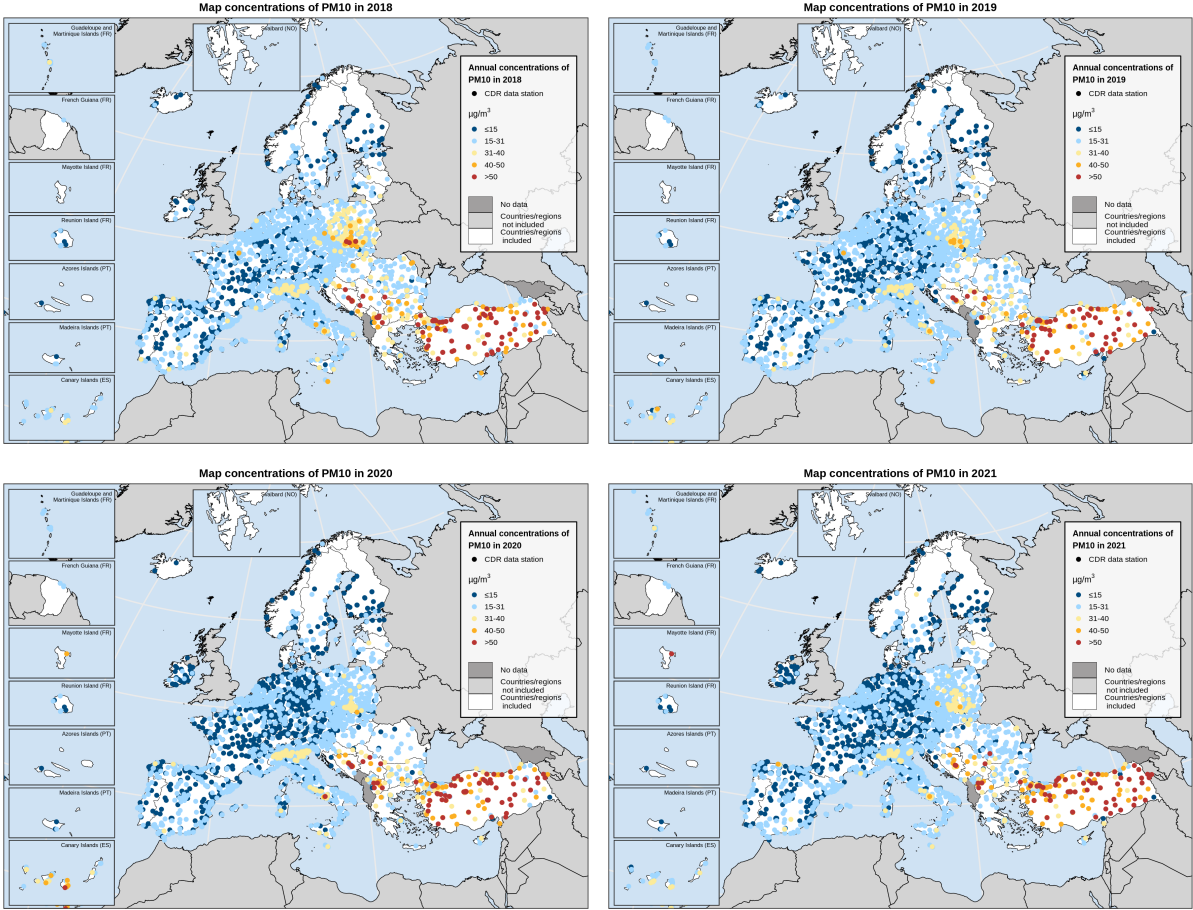
Note: Observed concentrations of PM<sub>10</sub> in 2021. The possibility of subtracting contributions to the measured concentrations from natural sources and winter road sanding/salting has not been considered. The last two colour categories indicate stations reporting concentrations above the EU annual limit value (40 µg/m<sup>3</sup>). The first colour category indicate stations reporting values below the WHO AQG level for PM<sub>10</sub> (15 µg/m<sup>3</sup>). Only stations with more than 75 % of valid data, and more than 13 % in the case of fixed random measurements, have been included in the map.



Note: The graph is based on annual mean concentration values. For each country, the number of stations considered for 2021 (in brackets) are given. The boxplot represents the lowest (bottom of the whisker), highest (top of the whisker) and average (black dot) annual mean values (in µg/m<sup>3</sup>). The rectangles mark the 25th and 75th percentiles. At 25 % of the stations, levels are below the 25th percentile; at 25 % of the stations, concentrations are above the 75th percentile. The annual limit value set by EU legislation is marked by the upper continuous horizontal line. The WHO AQG level is marked by the lower dashed horizontal line. The graph should be read in relation to the above map, as a country's situation depends on the number of stations considered.

Figure 6 shows the maps of PM<sub>10</sub> annual mean concentrations at station level for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

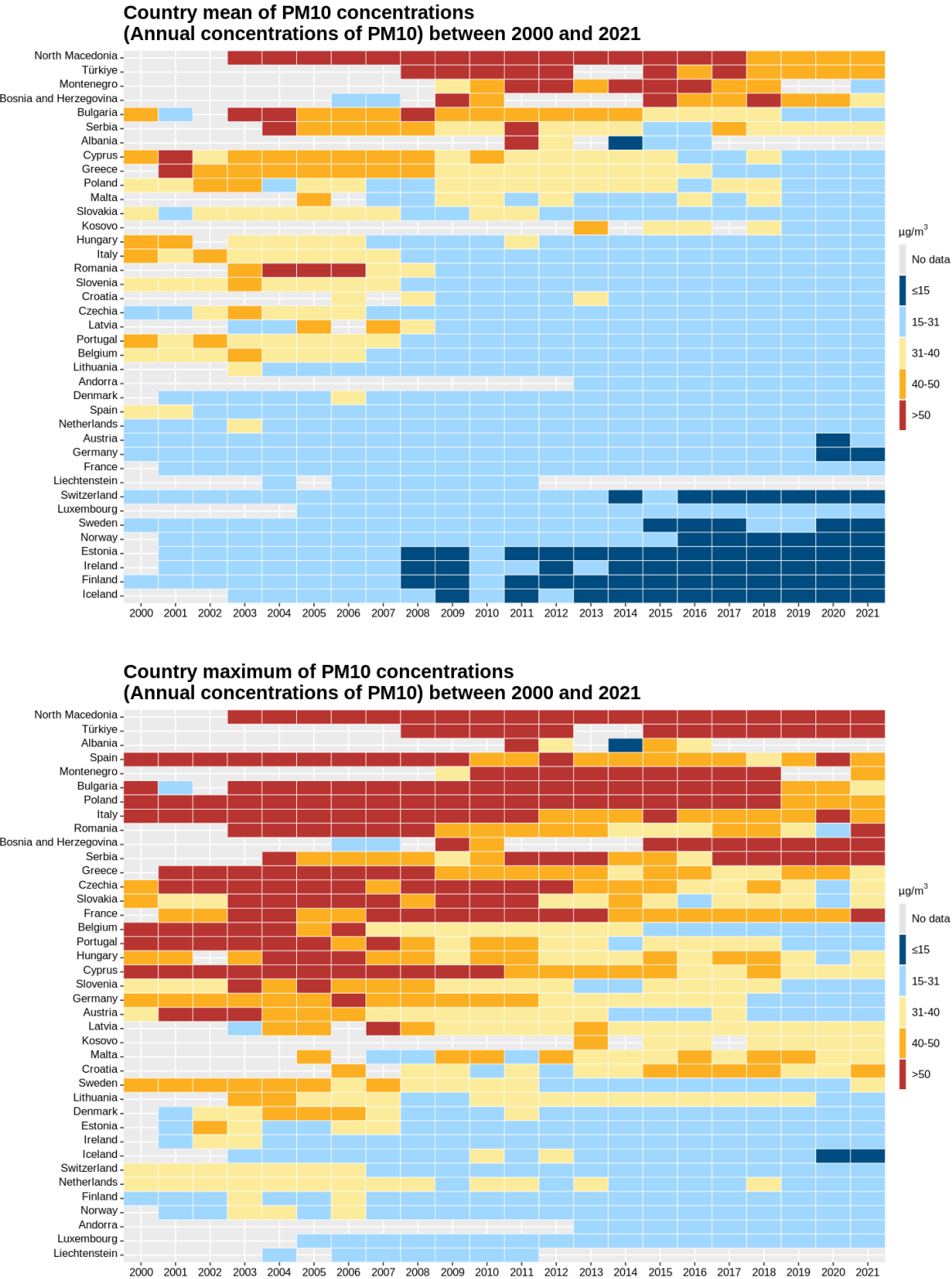
Figure 6: Maps of PM<sub>10</sub> concentrations (annual limit value) for the last 4 years



Maps for years before 2020 are different to the ones published in previous reports because the bands in the legend have been modified to accommodate the 2021 WHO AQG level.

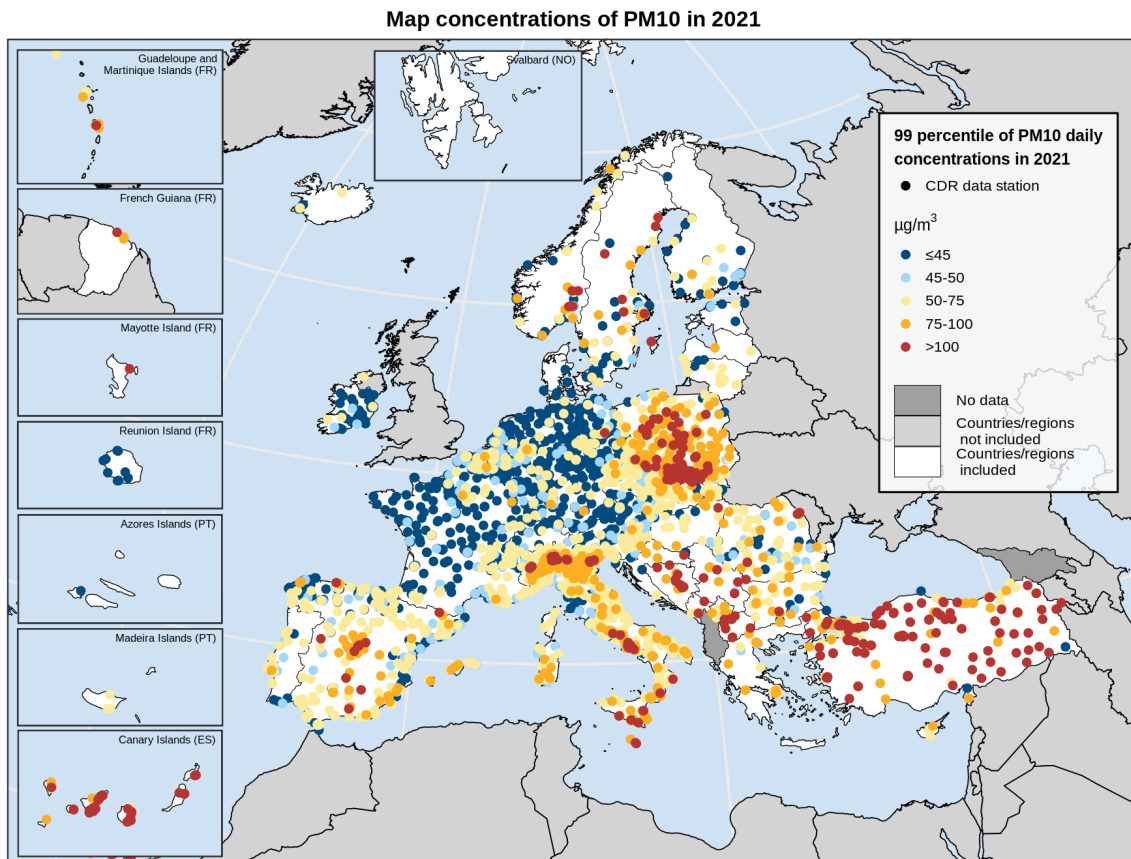
Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) annual mean PM<sub>10</sub> concentrations at country level are shown in figure 7. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 7: Evolution of mean (top) and maximum (bottom) PM<sub>10</sub> annual mean concentrations (annual limit value) per country from 2000



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

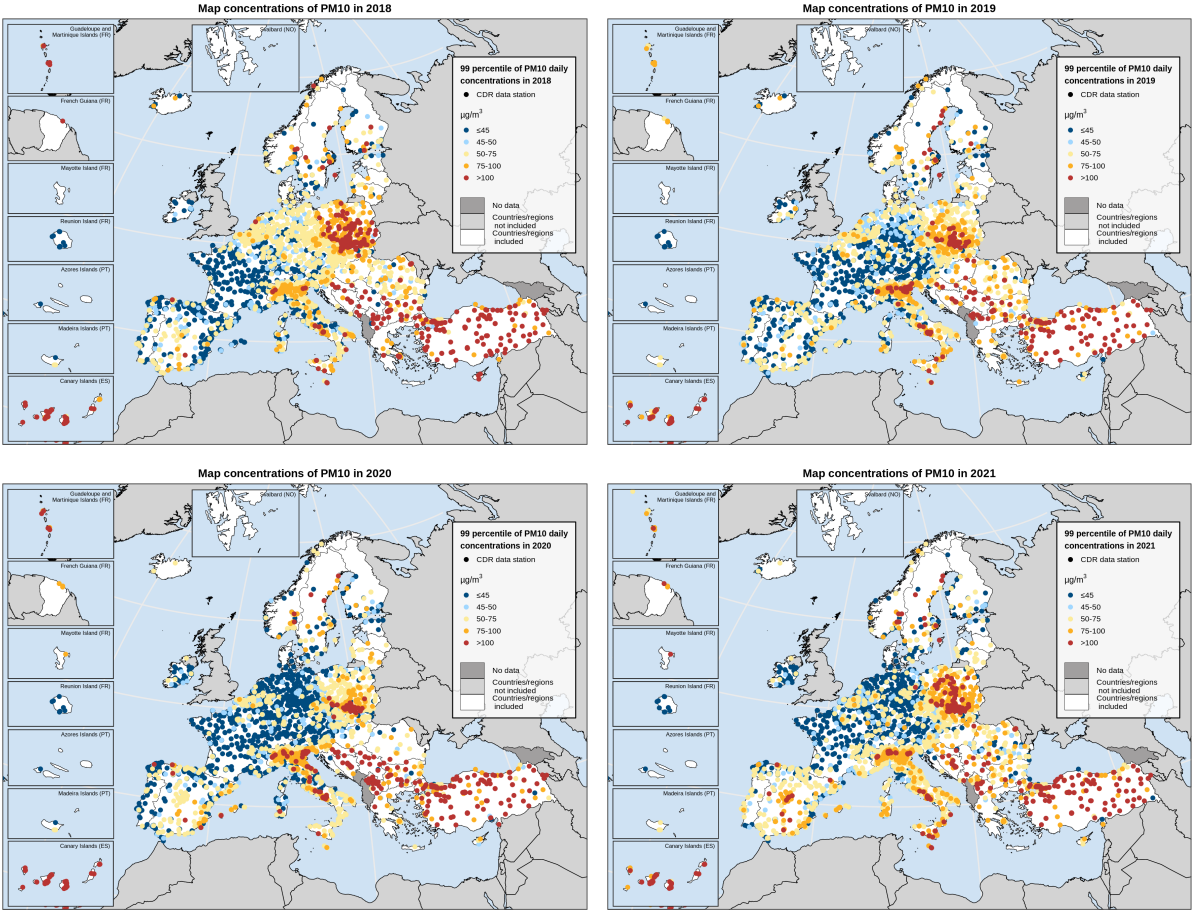
Figure 8: Map of PM<sub>10</sub> concentrations in 2021 - daily WHO AQG level



Note: Observed concentrations of PM<sub>10</sub> in 2021. The map shows the 99 percentile of the PM<sub>10</sub> daily mean concentrations, equivalent to 3–4 exceedance days per year, according to the definition of the daily WHO AQG level (45 µg/m<sup>3</sup>). The first colour category indicates stations with concentrations below this AQG level. Only stations with more than 75 % of valid data, and more than 13 % in the case of fixed random measurements, have been included in the map.

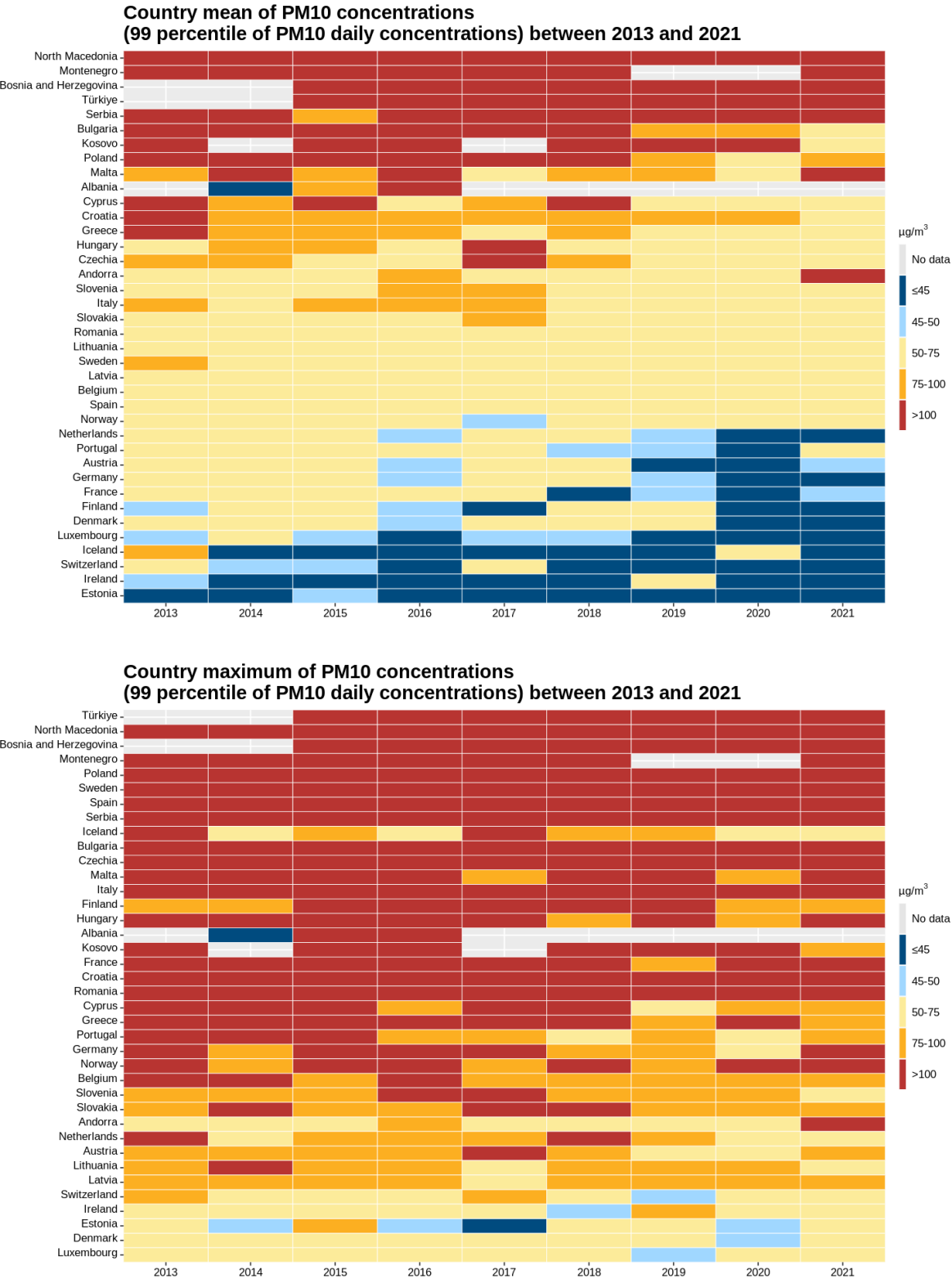
Figure 9 shows the maps of the 99 percentile of PM<sub>10</sub> daily mean concentrations (equivalent to the WHO AQG level for PM<sub>10</sub> daily mean level) for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

Figure 9: Maps of PM<sub>10</sub> concentrations (daily WHO AQG level) for the last 4 years



Heatmaps with the evolution from 2013 of the mean (top) and the maximum (bottom) 99 percentile of PM<sub>10</sub> daily mean concentrations at country level are shown in figure 10. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 10: Evolution of mean (top) and maximum (bottom) 99 percentile of PM<sub>10</sub> daily mean concentrations (daily WHO AQG level) per country from 2013



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

### 3.2 Status of PM<sub>2.5</sub> concentrations

Regarding PM<sub>2.5</sub>, data with a general minimum coverage of 75 %, and of 13 % for fixed random stations, of valid data were received from 1901 stations for the calculation of annual mean concentrations and from 1897 stations in relation to the short-term WHO AQG level. These stations were located in all the reporting countries shown in Figure 1.

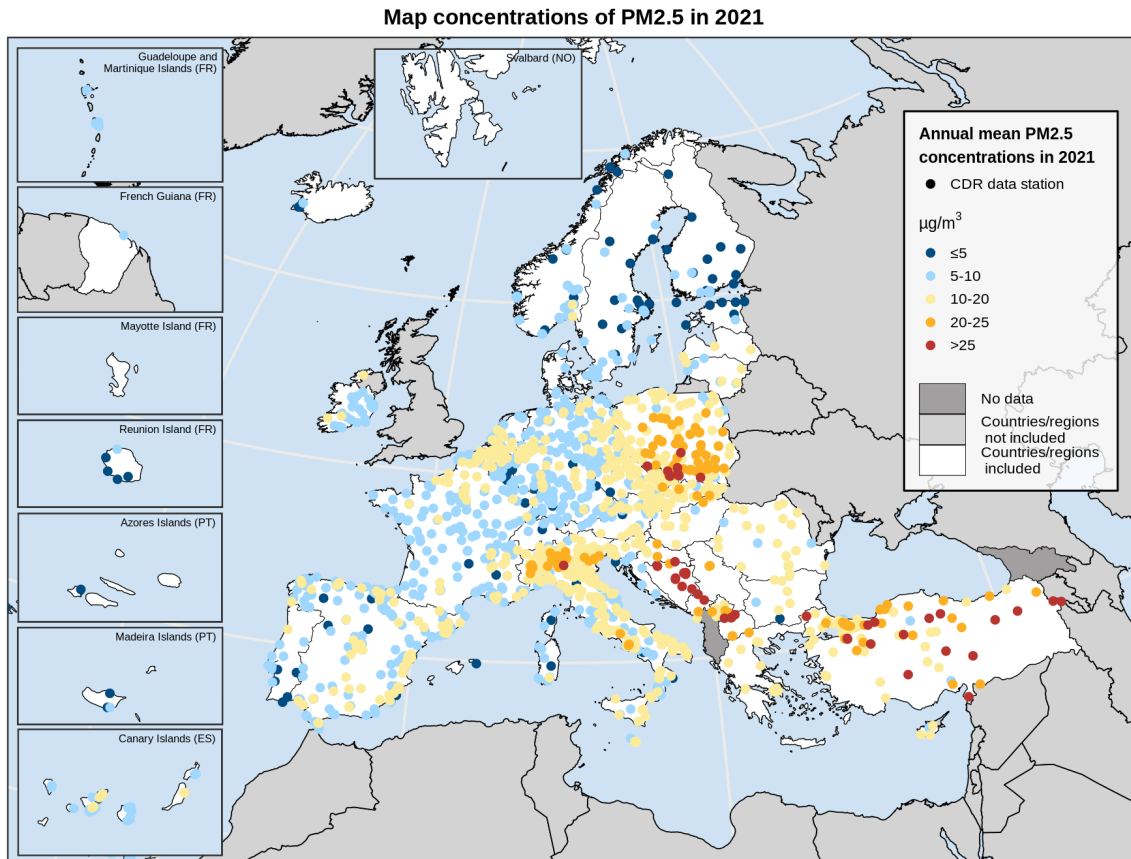
The PM<sub>2.5</sub> concentrations were higher than the EU annual limit value (25 µg/m<sup>3</sup>) in four countries in EU-27 and four other reporting countries (Figure 11). These concentrations above the limit value were registered in 2 % of all the reporting stations and occurred primarily (95 % of cases) in urban (72 %) or suburban (23 %) areas.

The WHO AQG level for PM<sub>2.5</sub> annual mean (5 µg/m<sup>3</sup>) was exceeded at 95 % of the stations, located in 37 of the 37 countries reporting PM<sub>2.5</sub> data (Figure 11).

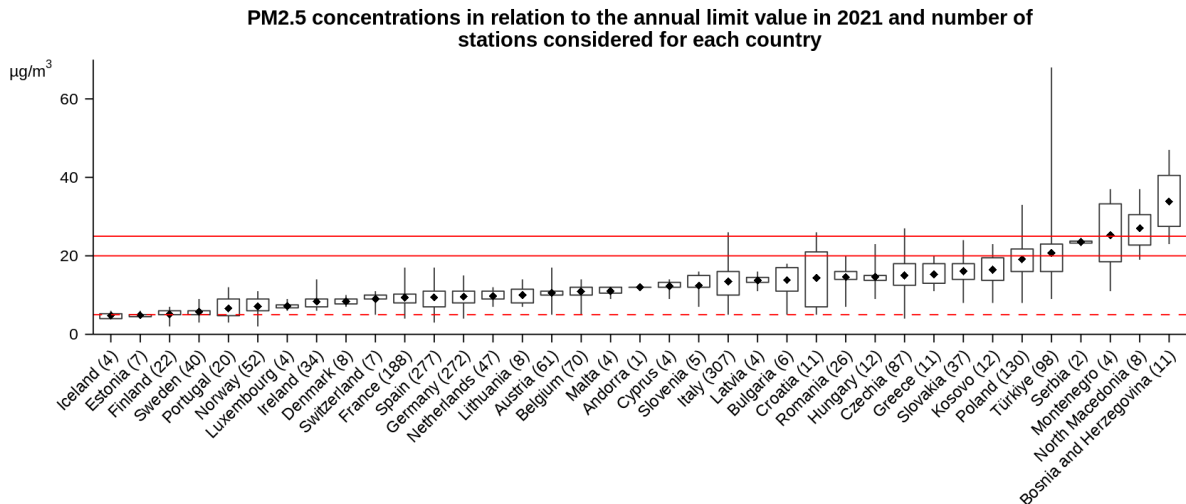
Although the EU has not set any short-term standard for PM<sub>2.5</sub>, the WHO defined in 2021 a daily AQG level of 15 µg/m<sup>3</sup>, expressed as percentile 99. It was exceeded at 98 % (1857 stations) of the stations in all the reporting countries (Figure 14).



Figure 11: Map and boxplot of PM<sub>2.5</sub> concentrations in 2021 - annual limit value



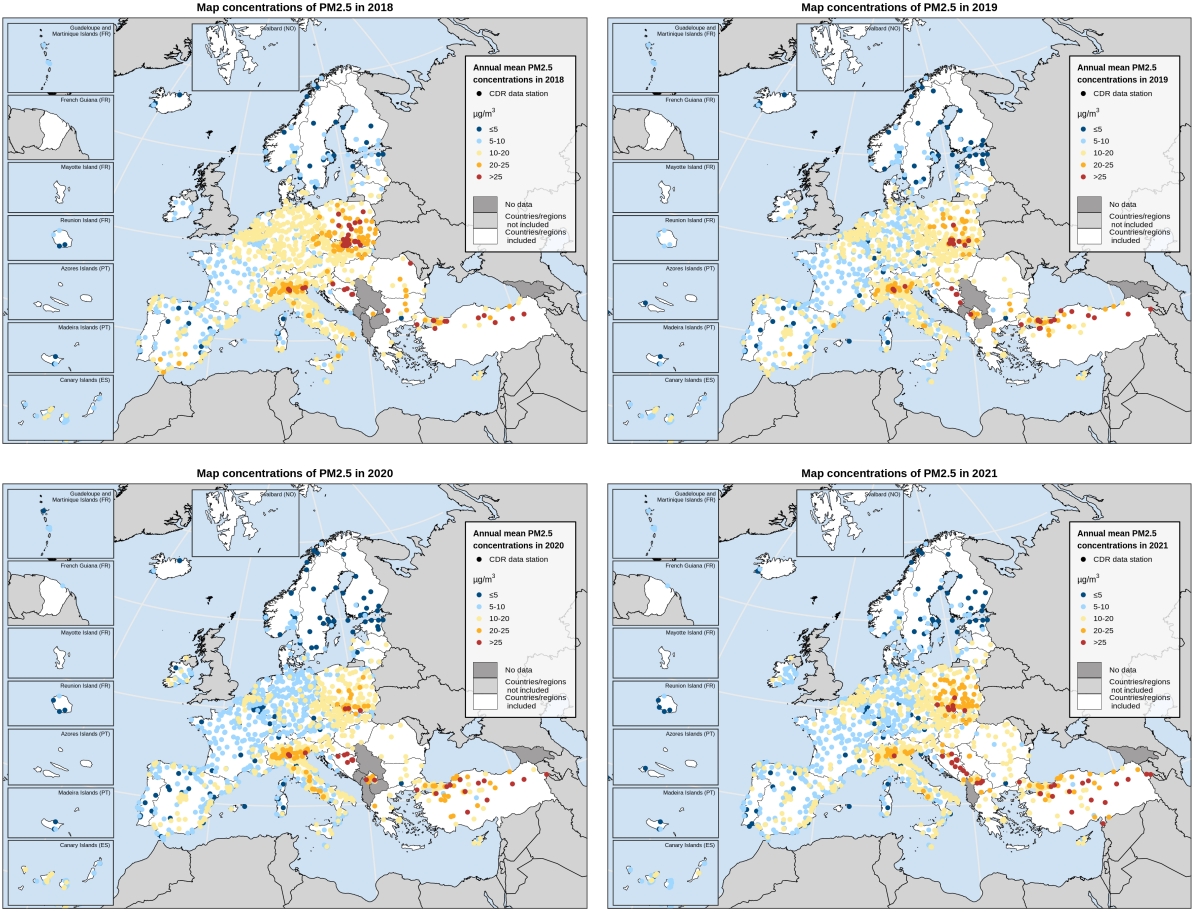
Note: Observed concentrations of PM<sub>2.5</sub> in 2021. The possibility of subtracting contributions to the measured concentrations from natural sources and winter road sanding/salting has not been considered. The last two colour categories indicate stations reporting concentrations above the EU indicative annual limit value (20 µg/m<sup>3</sup>) or the EU annual limit value (25 µg/m<sup>3</sup>). The first colour category indicates stations reporting values below the WHO AQG level for PM<sub>2.5</sub> (5 µg/m<sup>3</sup>). Only stations with more than 75 % of valid data, and more than 13% in the case of fixed random measurements, have been included in the map.



Note: The graph is based on annual mean concentration values. For each country, the number of stations considered for 2021 (in brackets) are given. The boxplot represents the lowest (bottom of the whisker), highest (top of the whisker) and average (black dot) annual mean values (in µg/m<sup>3</sup>). The rectangles mark the 25th and 75th percentiles. At 25 % of the stations, levels are below the 25th percentile; at 25 % of the stations, concentrations are above the 75th percentile. The annual limit value and the indicative annual limit value set by EU legislation are marked by the upper continuous horizontal lines at 25 and 20, respectively. The WHO AQG level is marked by the lower dashed horizontal line. The graph should be read in relation to the above map, as a country's situation depends on the number of stations considered.

Figure 12 shows the maps of measured PM<sub>2.5</sub> annual mean concentrations for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

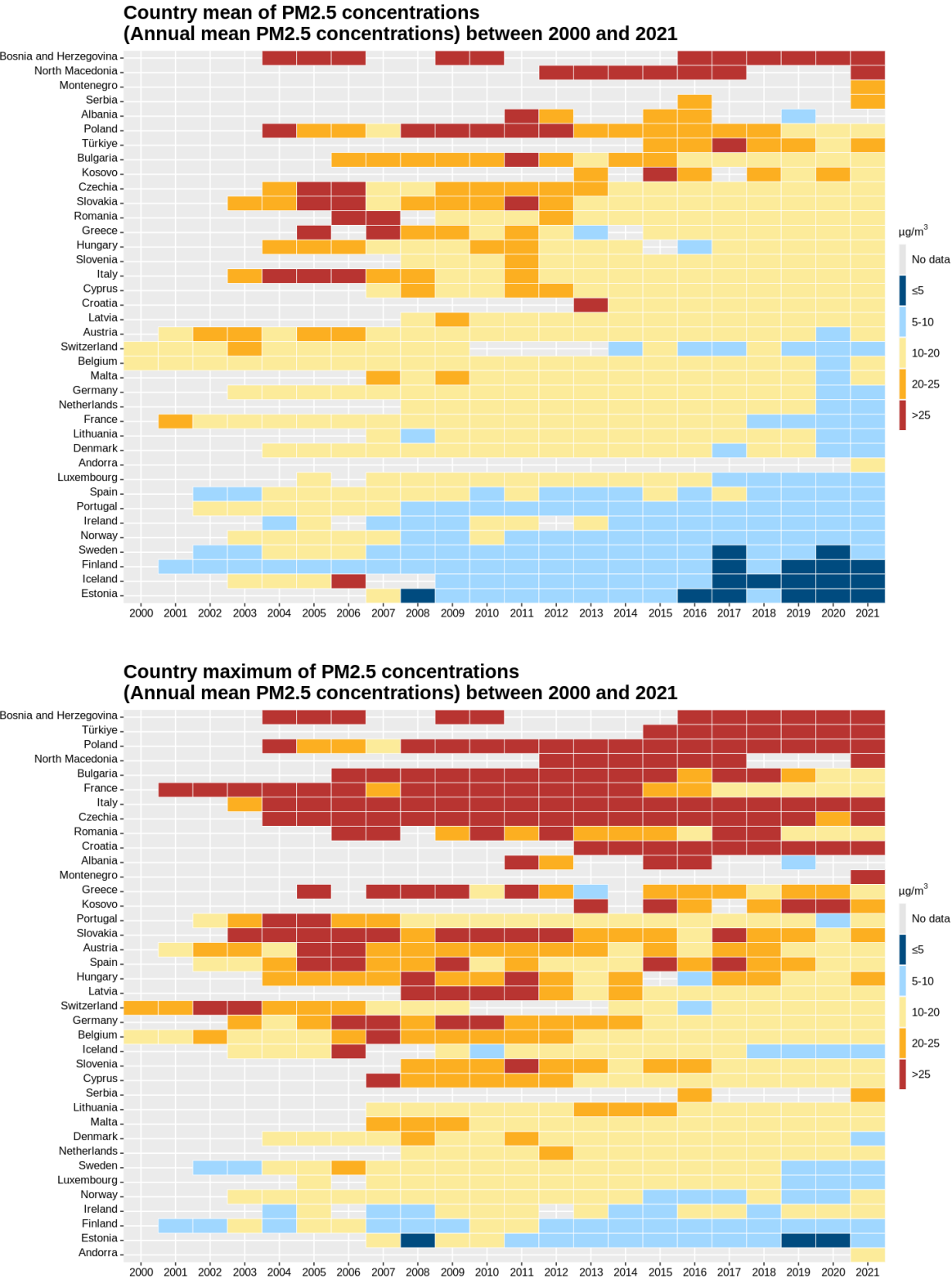
Figure 12: Maps of PM<sub>2.5</sub> concentrations (annual limit value) for the last 4 years



Maps for years before 2020 are different to the ones published in previous reports because the bands in the legend have been modified to accommodate the 2021 WHO AQG level.

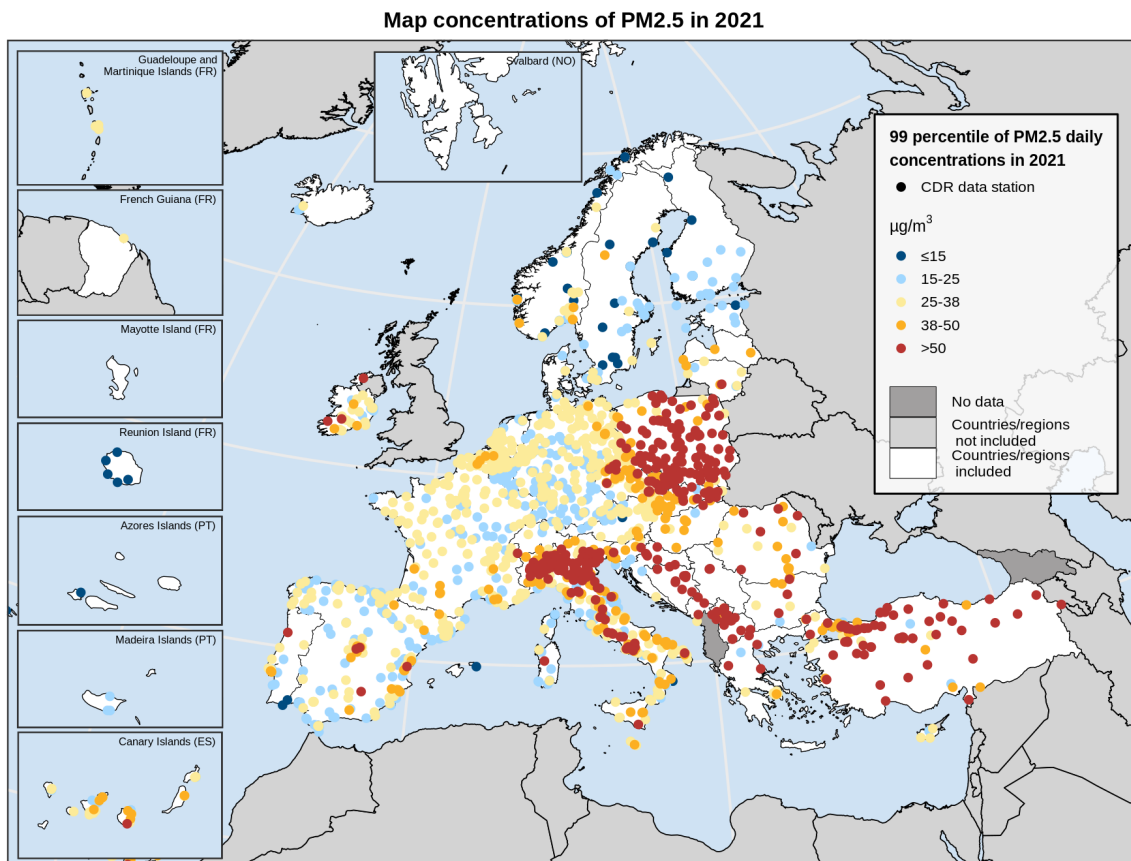
Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) PM<sub>2.5</sub> annual mean concentrations at country level are shown in figure 13. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 13: Evolution of mean (top) and maximum (bottom) PM<sub>2.5</sub> annual mean concentrations (annual limit value) per country from 2000



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

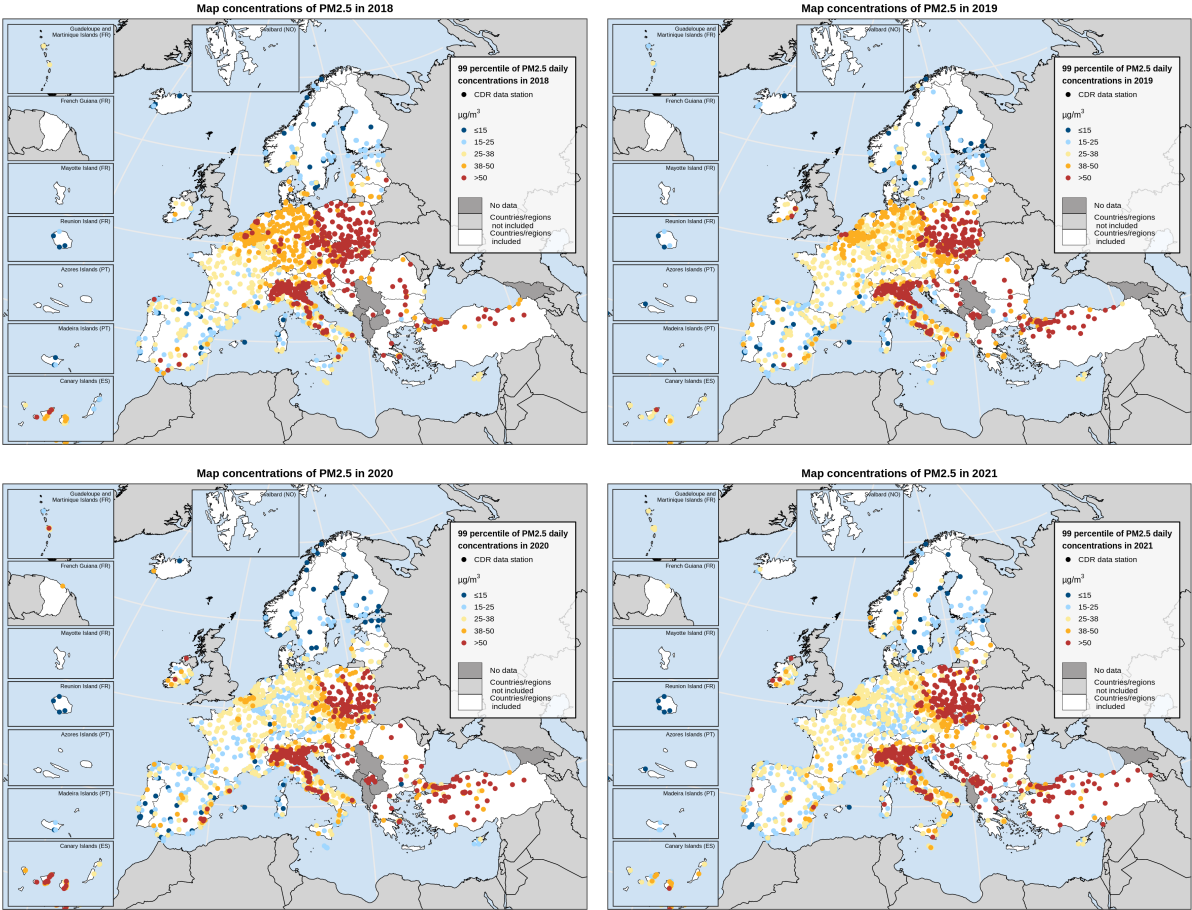
Figure 14: Map of PM<sub>2.5</sub> concentrations in 2021 - daily WHO AQG level



Note: Observed concentrations of PM<sub>2.5</sub> in 2021. The map shows the 99 percentile of the PM<sub>2.5</sub> daily mean concentrations, equivalent to 3–4 exceedance days per year, according to the definition of the daily WHO AQG level (15  $\mu\text{g}/\text{m}^3$ ). The first colour category indicates stations with concentrations below this AQG level. Only stations with more than 75 % of valid data, and more than 13 % in the case of fixed random measurements, have been included in the map.

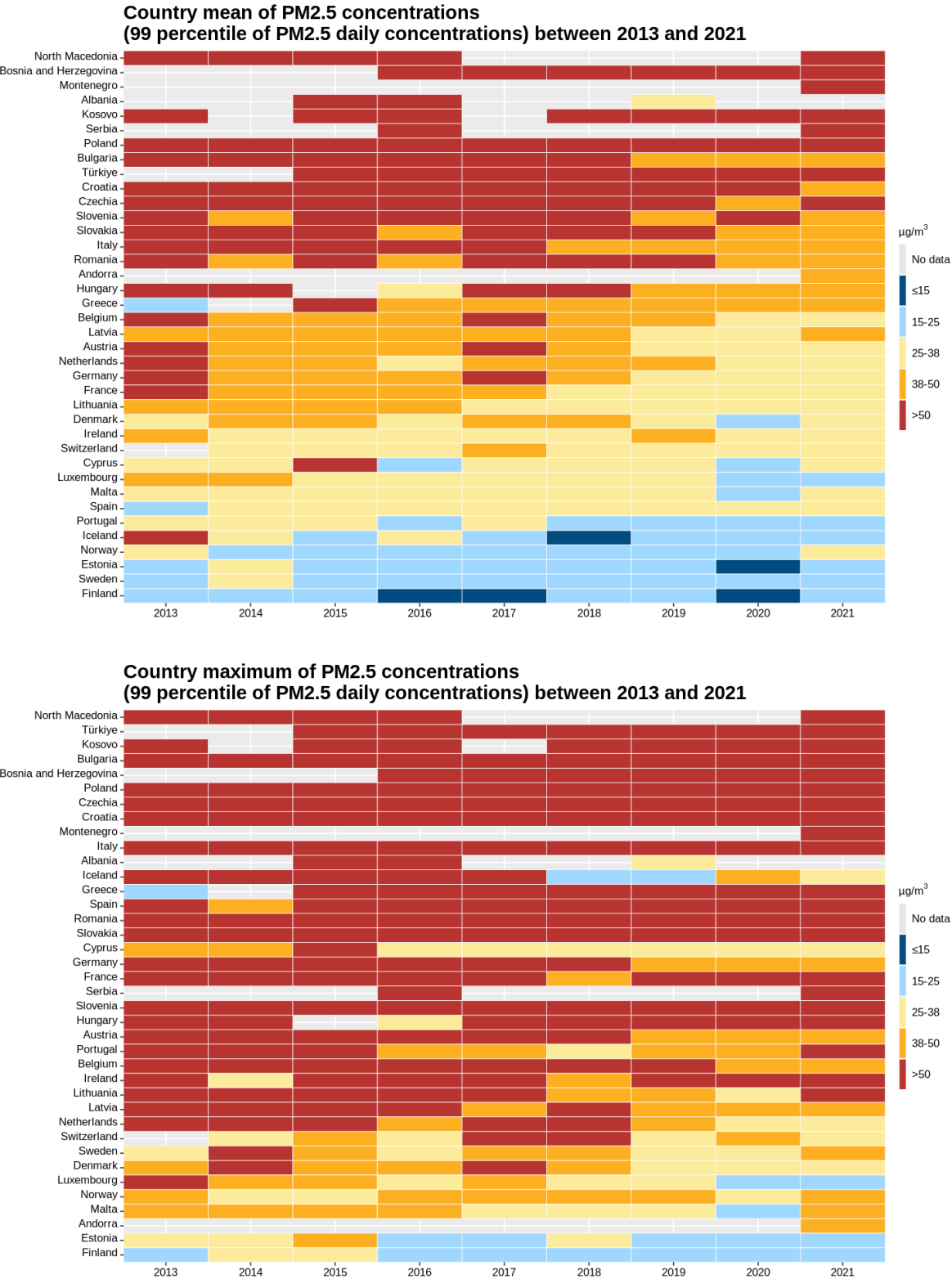
Figure 15 shows the maps of the 99 percentile of PM<sub>2.5</sub> daily mean concentrations (equivalent to the WHO AQG level for PM<sub>2.5</sub> daily mean level) for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

Figure 15: Maps of PM<sub>2.5</sub> concentrations (daily WHO AQG level) for the last 4 years



Heatmaps with the evolution from 2013 of the mean (top) and the maximum (bottom) 99 percentile of PM<sub>2.5</sub> daily mean concentrations at country level are shown in figure 16. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 16: Evolution of mean (top) and maximum (bottom) 99 percentile of PM<sub>2.5</sub> daily mean concentrations (daily WHO AQG level) per country from 2013



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

### 3.3 PM<sub>2.5</sub> average exposure indicator

The Ambient Air Quality Directive (EU, 2008) also sets two additional targets for PM<sub>2.5</sub>, the exposure concentration obligation (ECO) and the national exposure reduction target (NERT) (Table 1). Both targets are based on the average exposure indicator (AEI), calculated at national level. The AEI is an average of concentration levels (over a 3-year period) measured at urban background stations (representative of general urban population exposure) selected for this purpose by every national authority. The reference year for the AEI is 2010 (average 2008-2010), but the Ambient Air Quality Directive offered two additional alternatives when data are not available for 2008: (1) an alternative AEI 2010, with a 2-year average (2009 and 2010) instead of the 3-year average; or (2) the AEI 2011 (average 2009-2011). The exception is Croatia for which 2015 is the AEI reference year (average 2013-2015). The data presented here are analysed with reference to the official AEI reported by each country and stored in EEA's vocabulary <sup>(5)</sup> and presented in Table 5 in the Annex.

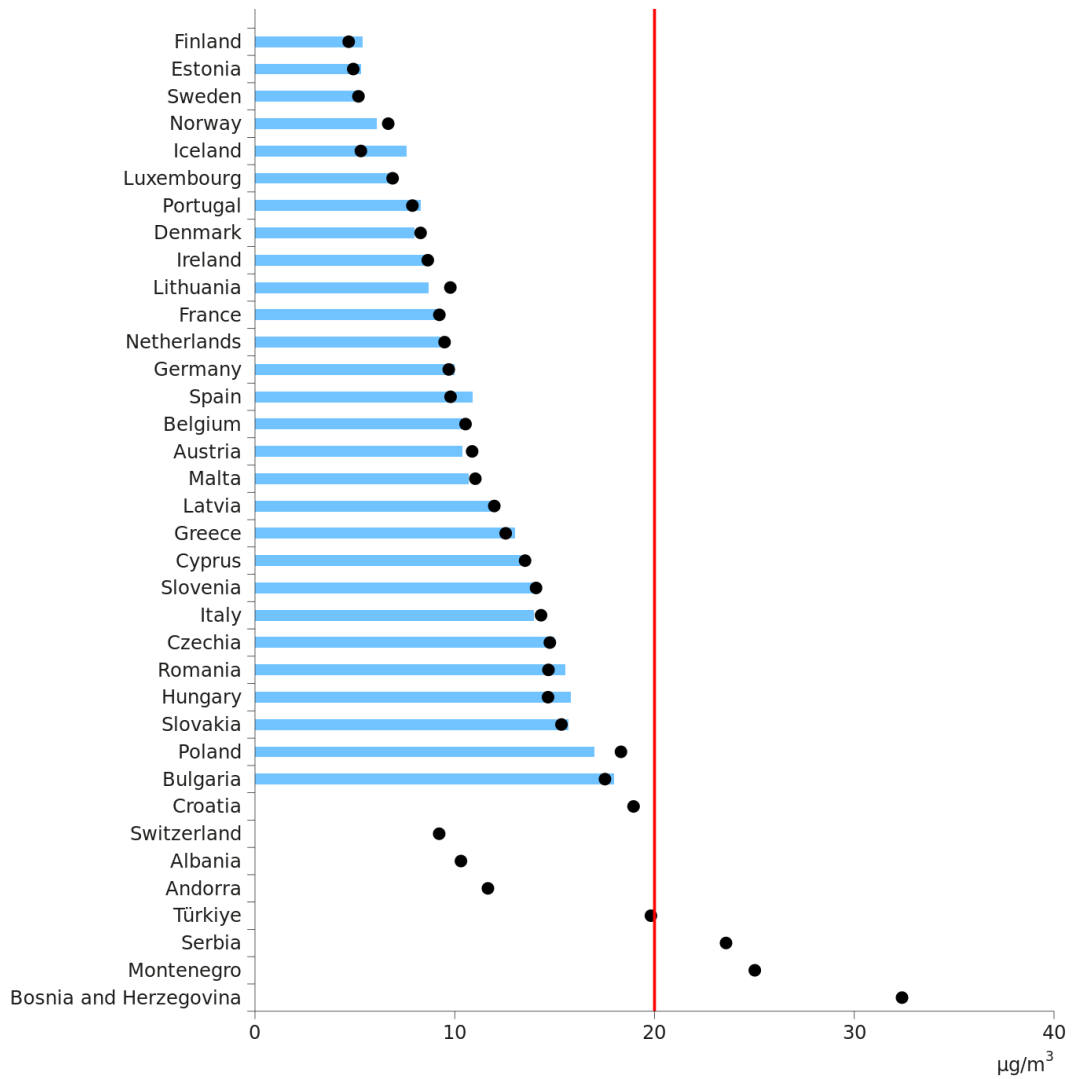
Figure 17 assesses PM<sub>2.5</sub> levels against the ECO threshold. It shows the AEI reported for 2021 (average 2019-2021) and the situation in relation to the ECO. The bars show the AEI 2021 as reported by countries under data flow G (Information on the attainment of environmental objectives) according to Article 12 of IPR Decision 2011/850/EU, while the dots show the 3-year (2019-2021) average concentrations from measurements at all urban and suburban background stations with 75 % data coverage. This calculation, covering the urban and suburban background stations, has been used in previous *Air quality in Europe* reports as an approximation of the AEI and is presented here for comparison with the information presented in those reports. The calculation using reported urban and suburban background stations is also made for the rest of the non-EU countries.

In Figure 17, the vertical line represents the ECO threshold, set at 20 µg/m<sup>3</sup>. For those countries whose bars are to the right of the vertical line, the AEI is above the ECO (based on reported information in data-flow G). For those countries whose dots are to the right of the vertical line, the 3 year average calculated from reported urban and suburban background stations is above the ECO.

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<sup>5</sup><https://dd.eionet.europa.eu/vocabulary/aq/exposurereductiontarget/view>.

Figure 17: Average exposure indicator in 2021 and exposure concentration obligation

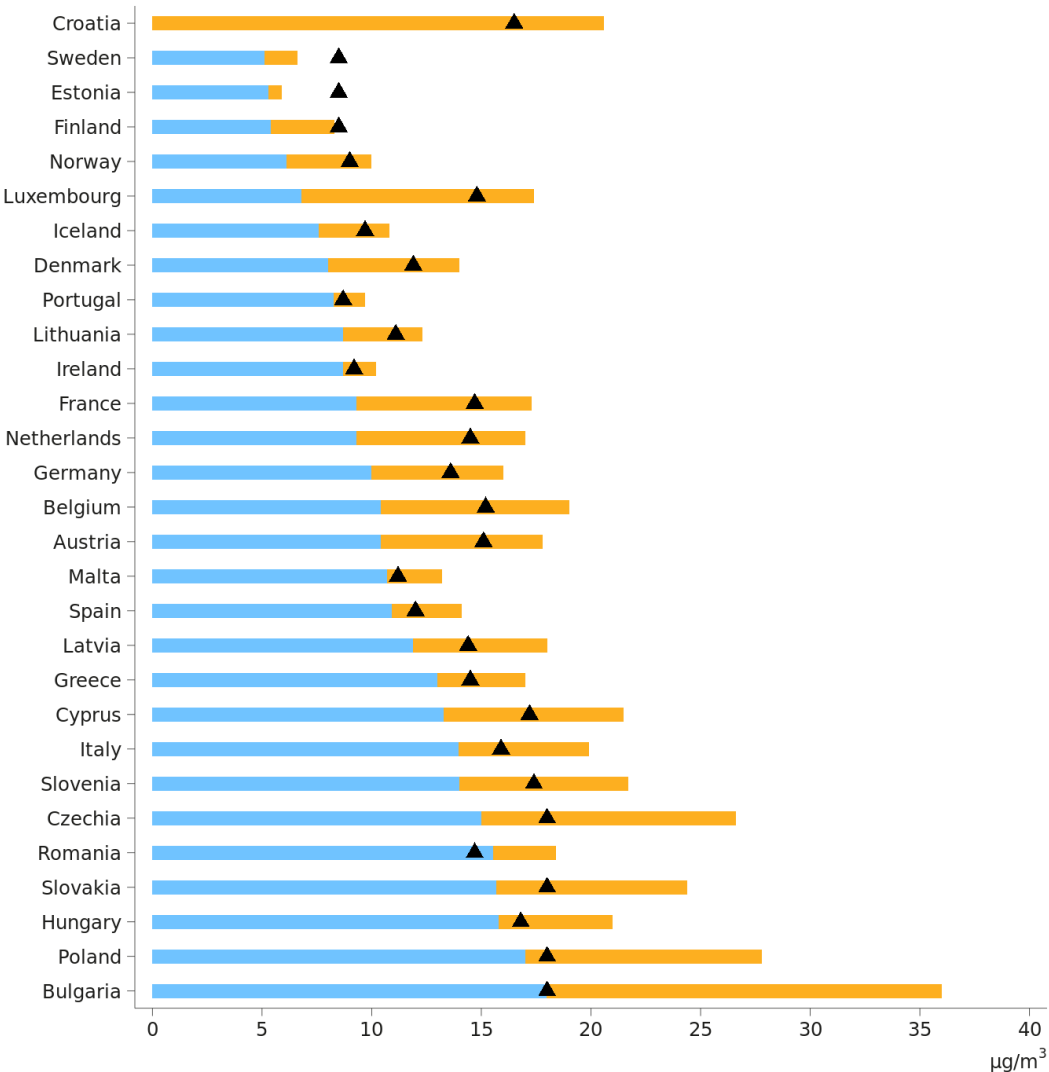


Note: The bars show the average exposure indicator (AEI) calculated in 2021 (averages 2019–2021) as reported by countries under data flow G (Information on the attainment of environmental objectives) according to Article 12 of IPR Decision 2011/850/EU. The dots show the 3 year (2019–2021) average of all urban and suburban background PM2.5 concentrations (for stations with at least 75 % of data coverage) in all reporting countries, to facilitate comparison with information provided in previous Air quality in Europe reports. The vertical line represents the exposure concentration obligation (ECO) for the countries in EU–27, set at 20 µg/m³, to be achieved as of 2015.



Figure 18 shows the situation per country in relation to the NERT. The total stacked bar (both blue and orange parts) represents the initial baseline AEI for 2010 or 2011 as reported by each country expressed in  $\mu\text{g}/\text{m}^3$  (see Table 5 in Annex). The blue part is the latest reported AEI for 2021, as it can also be seen in figure 17. The triangles indicate the NERT level to be attained from 2020 onwards. Figure 18 shows those countries that have reduced their AEI below their corresponding NERT, estimated from their initial AEI baseline, (those whose triangle is over the orange bar) and those that did not (triangles over the blue part of the bar).

Figure 18: Percentage of reduction in AEI 2021 in relation to AEI 2011 and distance to the national exposure reduction target



Note: The total stacked bar indicate the initial baseline AEI for 2010 or 2011 (AEI 2015 in the case of Croatia, see the main text).  
 Triangles indicate the NERT to be met in 2021 applying the percentage reduction to the AEI baseline.  
 If the triangle is over the orange part of the stack bar, the NERT was achieved in 2021,  
 if the triangle is over the blue part of the bar, the NERT is not met.

## 4 Status of ozone ambient air concentrations

Data for O<sub>3</sub> were reported from 2198 stations for the calculation of EU standards, from 2198 stations in relation to the short-term WHO AQG level, and from 2082 stations for the long-term WHO AQG level. These stations were located in all the reporting countries shown in Figure 1.

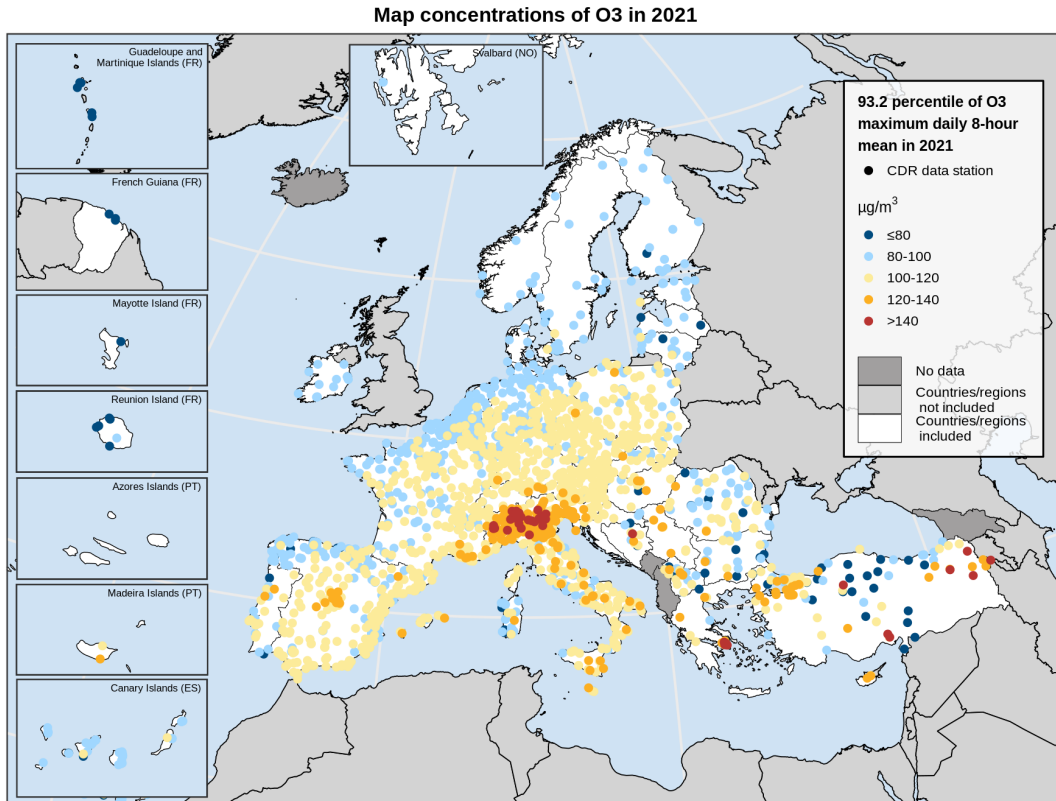
16 countries in EU-27 and 6 other reporting countries registered concentrations above the O<sub>3</sub> target value (120 µg/m<sup>3</sup>) more than 25 times (Figure 19). In total, 12 % of all stations reporting O<sub>3</sub> showed concentrations above the target value for the protection of human health. In addition, only 21 % (452) of all stations fulfilled the long-term objective (120 µg/m<sup>3</sup>). 86 % of the stations with values above the long-term objective were background stations.

10 % (210) of all stations and only 21 of the 551 reported rural background stations had values below the short-term WHO AQG value for O<sub>3</sub> (100 µg/m<sup>3</sup>) (Figure 22), set for the protection of human health. The long-term, peak season<sup>6</sup>, WHO AQG level (60 µg/m<sup>3</sup>) was exceeded in 97 % (2022) of all stations located in 27 countries in EU-27 and 8 other reporting countries. Only 1 of the 535 reported rural background stations had values below this AQG level (Figure 25).

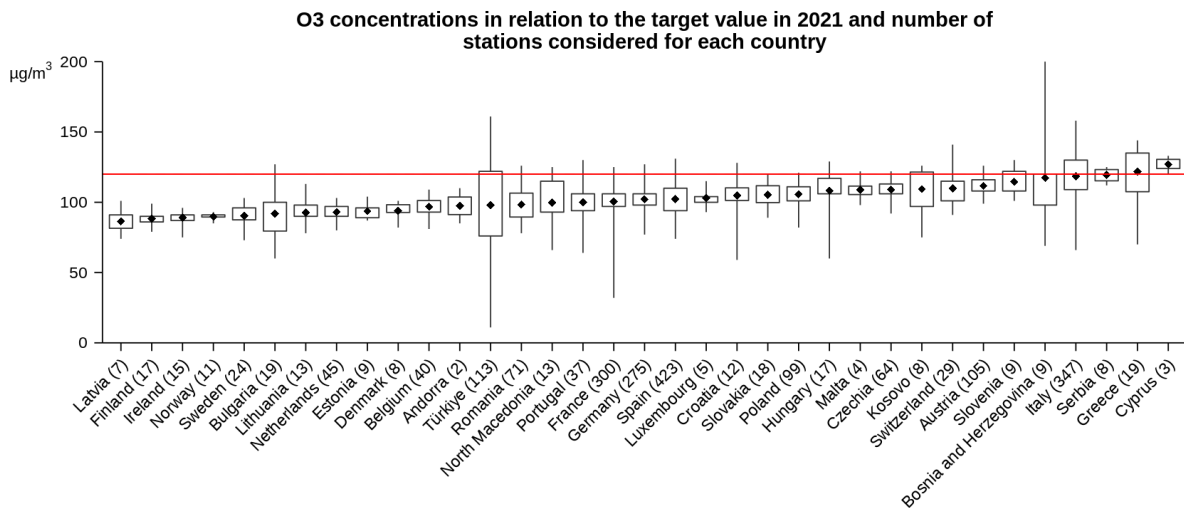
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<sup>6</sup>The peak season is calculated for each station as the average of daily maximum 8-hour mean O<sub>3</sub> concentration in the six consecutive months with the highest six-month running-average O<sub>3</sub> concentration. That means that, for each station, twelve 6-months running averages of the daily 8-h max are calculated (1 August YY-1 to 31 January YY, ..., 1 January YY to 30 June YY, ..., 1 July YY to 31 December YY) and the maximum of those 12 values is selected as the peak season concentration. Please check also Data Dictionary - Vocabulary (<https://dd.eionet.europa.eu/vocabularyconcept/aq/aggregationprocess/P1Y-maxP6M-P8H-dmax/view?vocabularyFolder.workingCopy=false&facet=HTML+Representation>).

Figure 19: Map and boxplot of O<sub>3</sub> concentrations in 2021



Note: Observed concentrations of O<sub>3</sub> in 2021. The map shows the 93.2 percentile of the O<sub>3</sub> maximum daily 8-hour mean, representing the 26th highest value in a complete series. It is related to the O<sub>3</sub> target value. At sites marked with the last two colour categories, the 26th highest daily O<sub>3</sub> concentrations were above the 120 µg/m<sup>3</sup> threshold, implying values above the target value threshold. Please note that the legal definition of the target value considers not only 1 year but the average over 3 years. Only stations with more than 75 % of valid data have been included in the map.

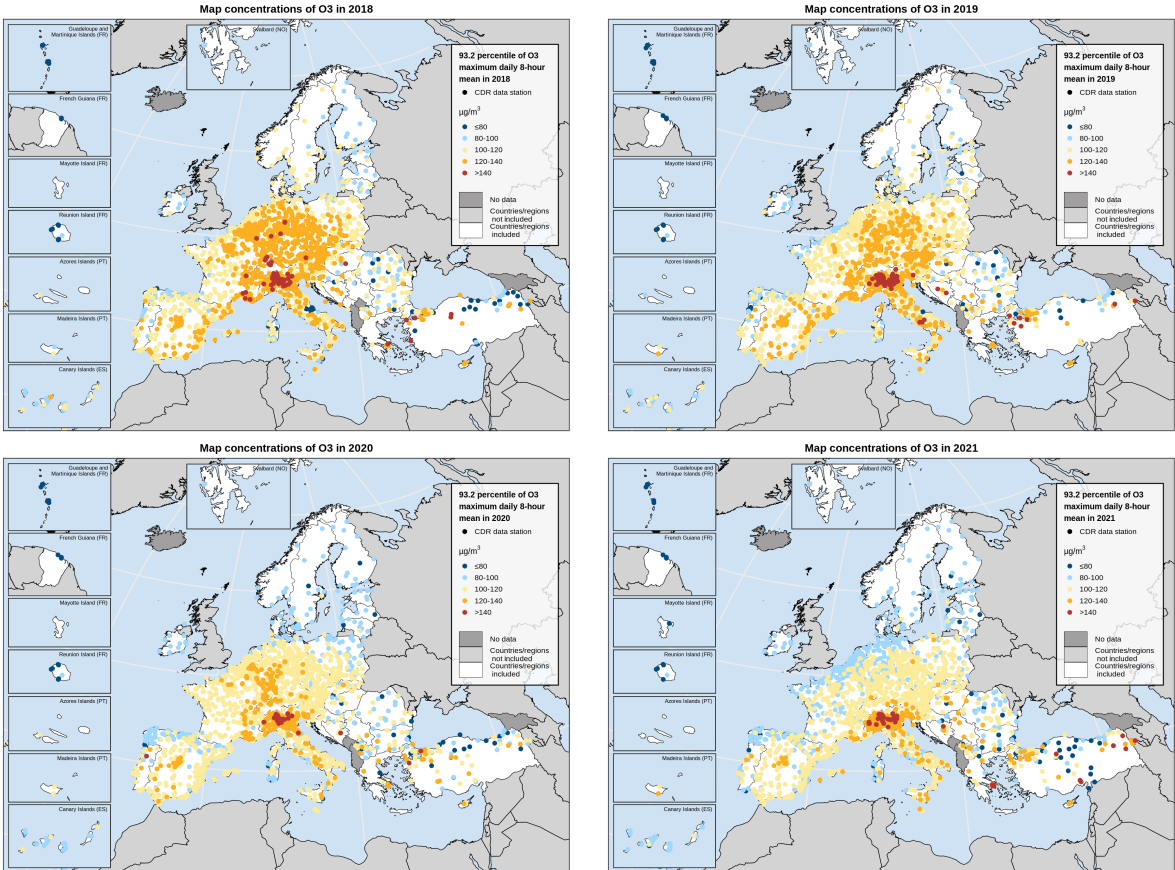


Note: The graph is based, for each country, on the 93.2 percentile of the maximum daily 8-hour mean concentration values, corresponding to the 26th highest daily maximum of the running 8-hour mean in a complete time series. For each country, the number of stations considered for 2021 (in brackets) are given. The boxplot represents the lowest (bottom of the whisker), highest (top of the whisker) and average (black dot) values (in µg/m<sup>3</sup>). The rectangles mark the 25th and 75th percentiles. At 25 % of the stations, levels are below the 25th percentile; at 25 % of the stations, concentrations are above the 75th percentile. The target value threshold set by the EU legislation is marked by the horizontal line. Please note that the legal definition of the target value considers not only 1 year but the average over 3 years. The graph should be read in relation to the above map, as a country's situation depends on the number of stations considered.

The highest value in the boxplot, Bosnia and Herzegovina (215 µg/m<sup>3</sup>), has not been included in the graph for representation purposes.

Figure 20 shows the maps of the observed 93.2 percentile of the O<sub>3</sub> maximum daily 8-hour mean concentrations (O<sub>3</sub> target value) for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

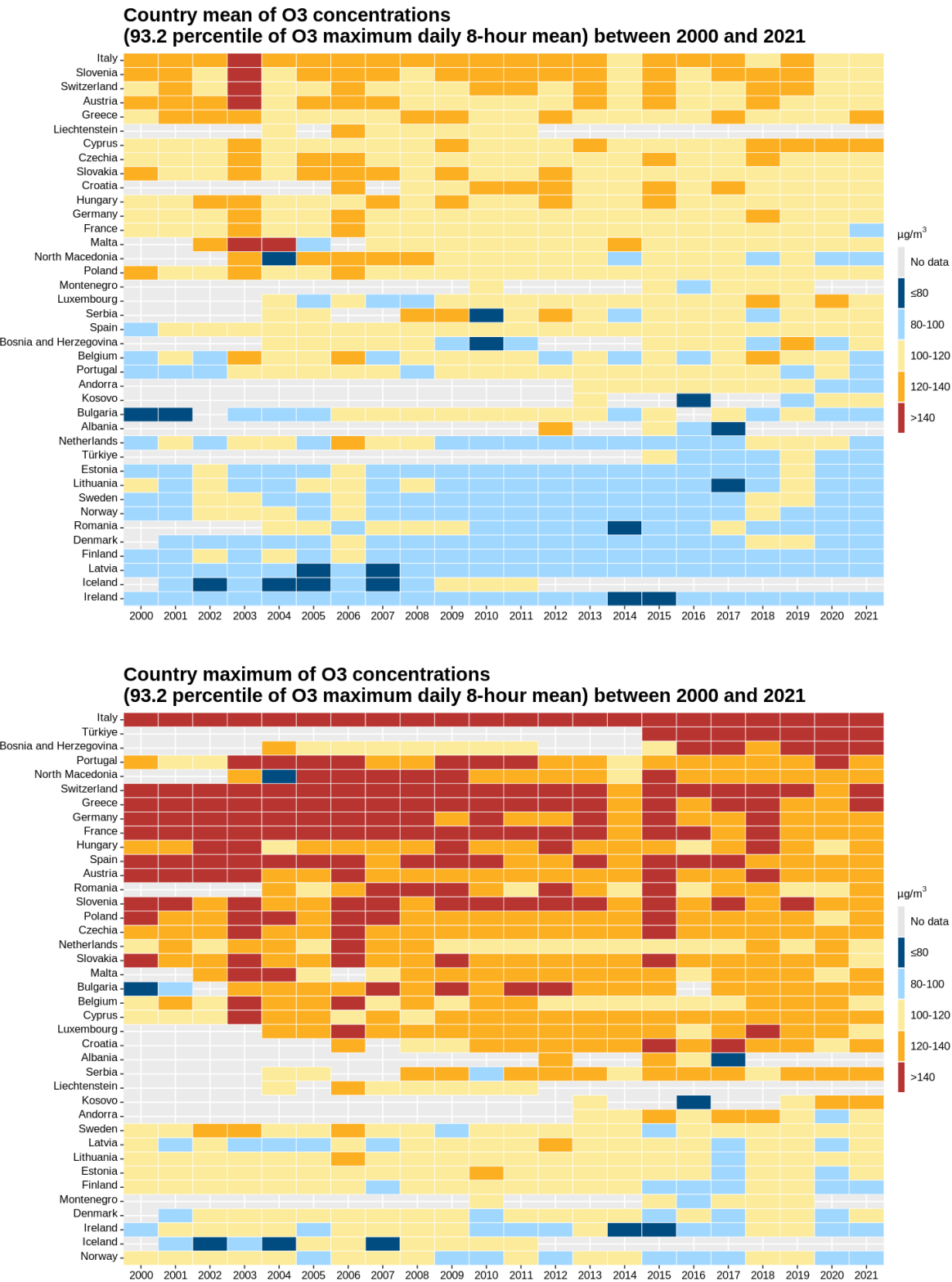
Figure 20: Maps of O<sub>3</sub> concentrations (related to the target value) for the last 4 years



Note: Please be aware that the TV considers the average over 3 years and the maps only show the situation for one specific year.

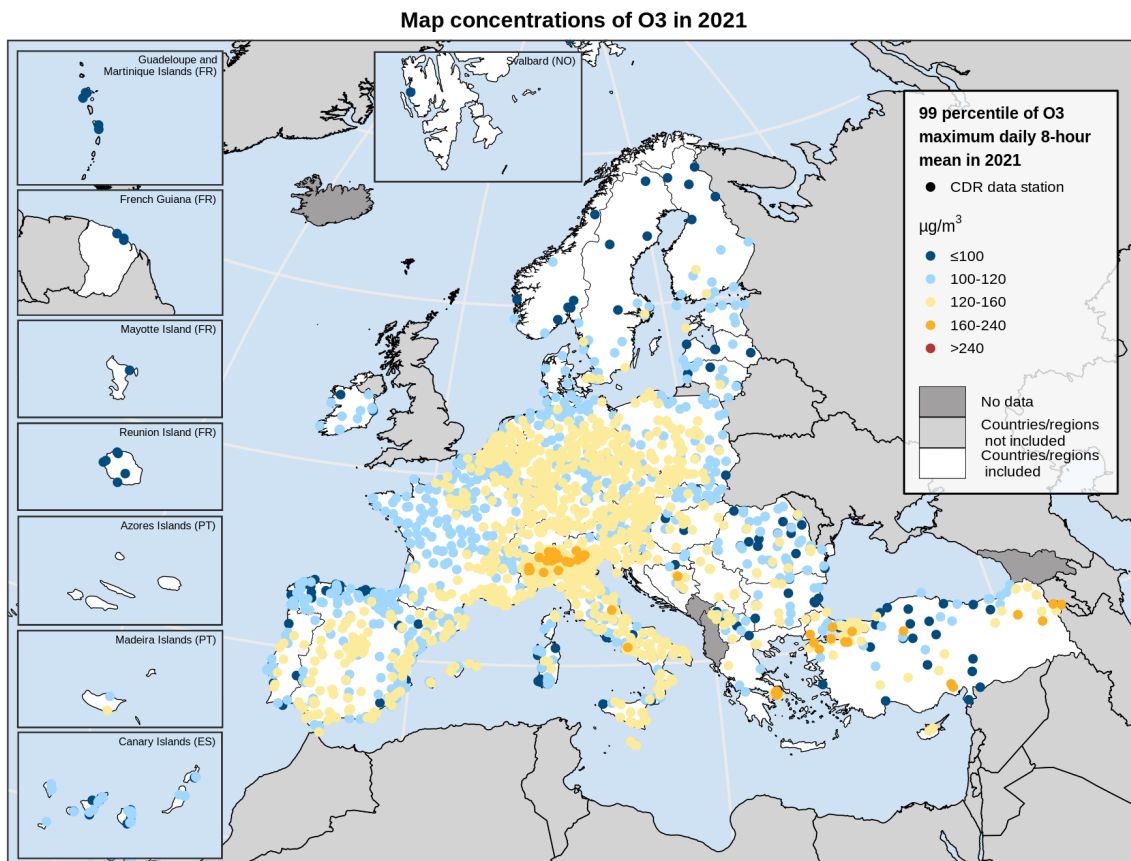
Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) O<sub>3</sub> concentrations (93.2 percentile of the maximum daily 8-hour mean concentration, target value) at country level are shown in figure 21. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020), especially for O<sub>3</sub> as higher ambient air temperature leads to enhanced photochemical reactions and O<sub>3</sub> formation.

Figure 21: Evolution of mean (top) and maximum (bottom) O<sub>3</sub> concentrations (93.2 percentile of the maximum daily 8-hour mean concentration, related to the target value) per country from 2000



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

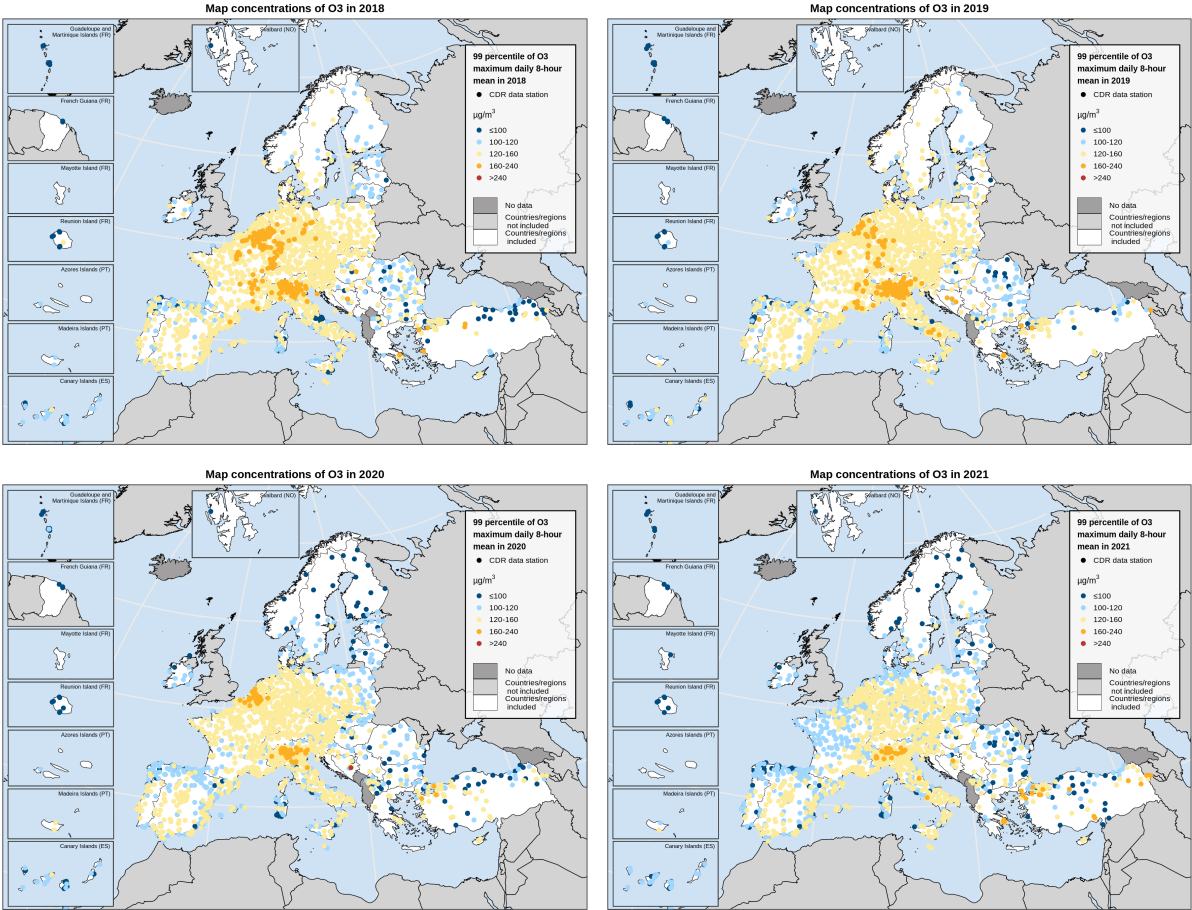
Figure 22: Map of O<sub>3</sub> concentrations in 2021 - short-term WHO AQG level



Note: Observed concentrations of O<sub>3</sub> in 2021. The map shows the 99 percentile of the O<sub>3</sub> maximum daily 8-hour mean concentrations, equivalent to 3–4 exceedance days per year, according to the definition of the short-term WHO AQG level (100 µg/m<sup>3</sup>). The first colour category indicates stations with concentrations below this AQG level. Only stations with more than 75 % of valid data have been included in the map.

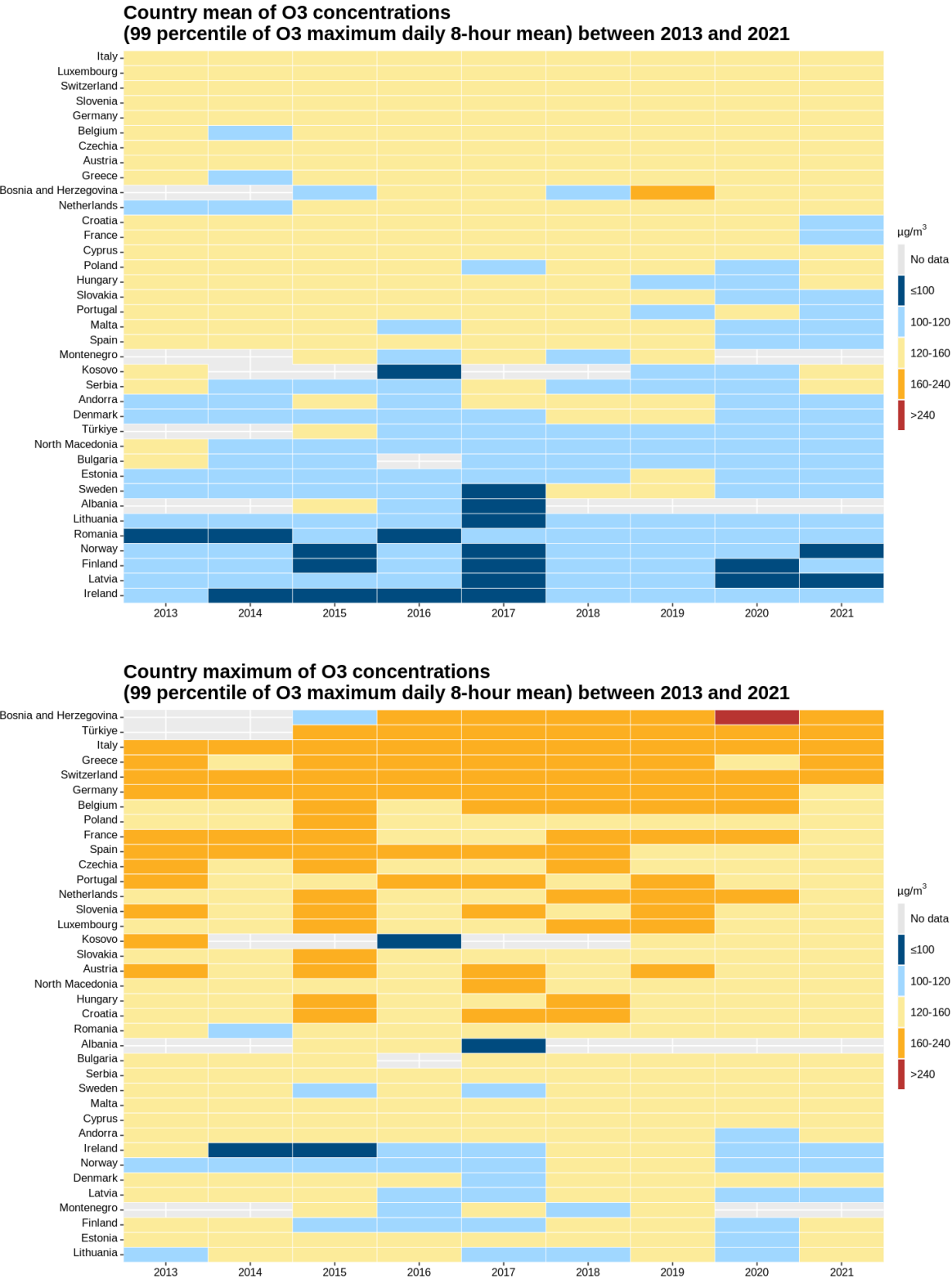
Figure 23 shows the maps of the 99 percentile of the O<sub>3</sub> maximum daily 8-hour mean concentrations (equivalent to the short-term WHO AQG level) for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

Figure 23: Maps of O<sub>3</sub> concentrations (short-term WHO AQG level) for the last 4 years



Heatmaps with the evolution from 2013 of the mean (top) and the maximum (bottom) 99 percentile of the O<sub>3</sub> maximum daily 8-hour mean concentrations at country level are shown in figure 24. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

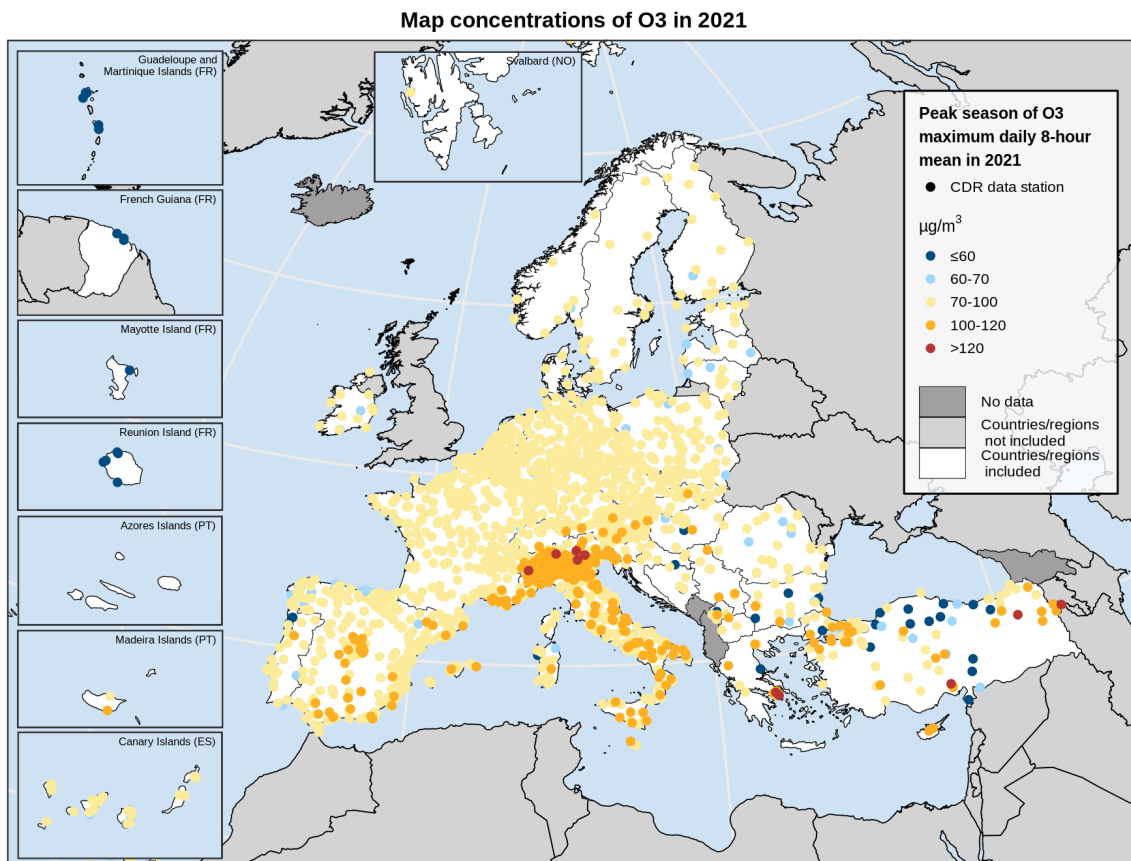
Figure 24: Evolution of mean (top) and maximum (bottom) 99 percentile of the O<sub>3</sub> maximum daily 8-hour mean concentrations per country from 2013



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.



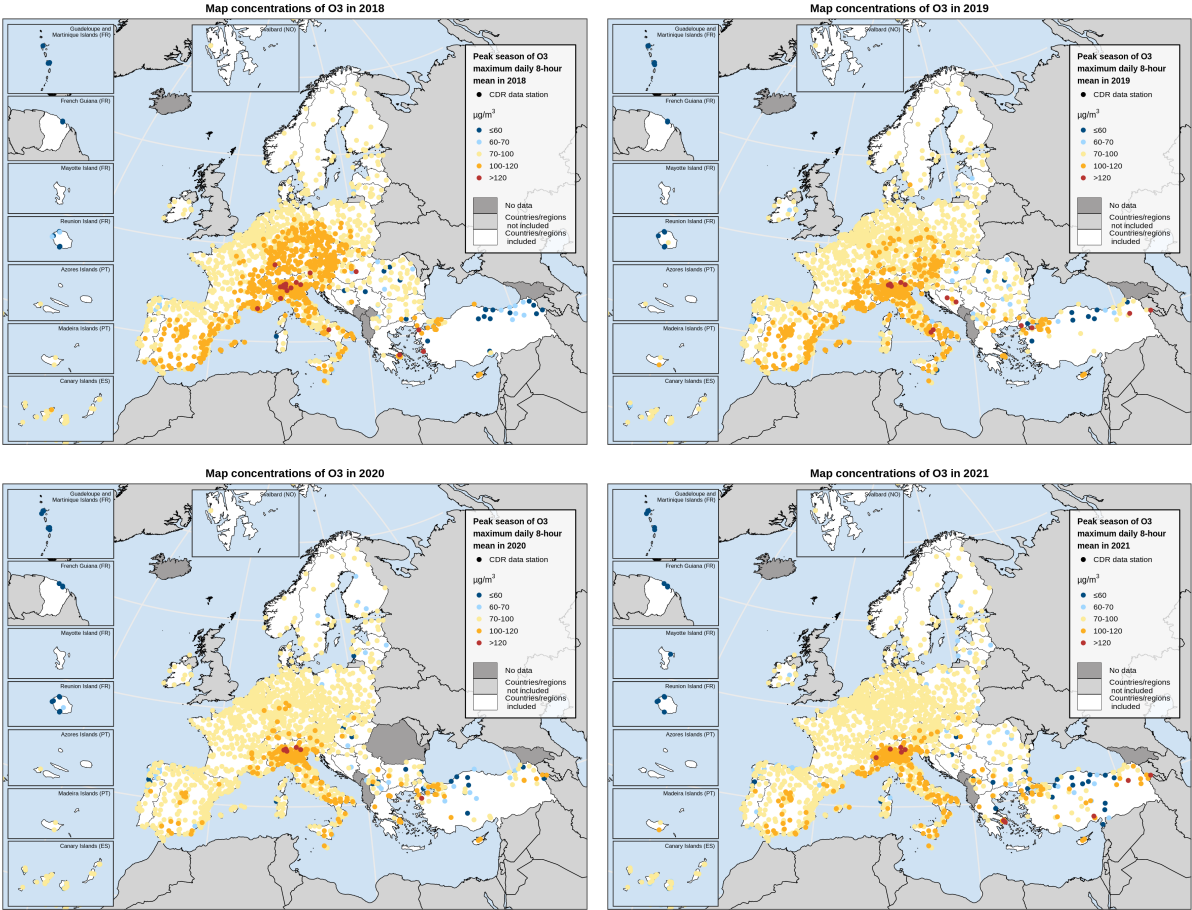
Figure 25: Map of peak season O<sub>3</sub> concentrations in 2021



Note: Observed concentrations of O<sub>3</sub> in 2021. The map shows the average of the daily maximum 8-hour mean O<sub>3</sub> concentration in the six consecutive months with the highest six-month running-average O<sub>3</sub> concentration. The first colour category represents stations fulfilling the peak season O<sub>3</sub> AQG level. Only stations with more than 75 % of valid data have been included in the map.

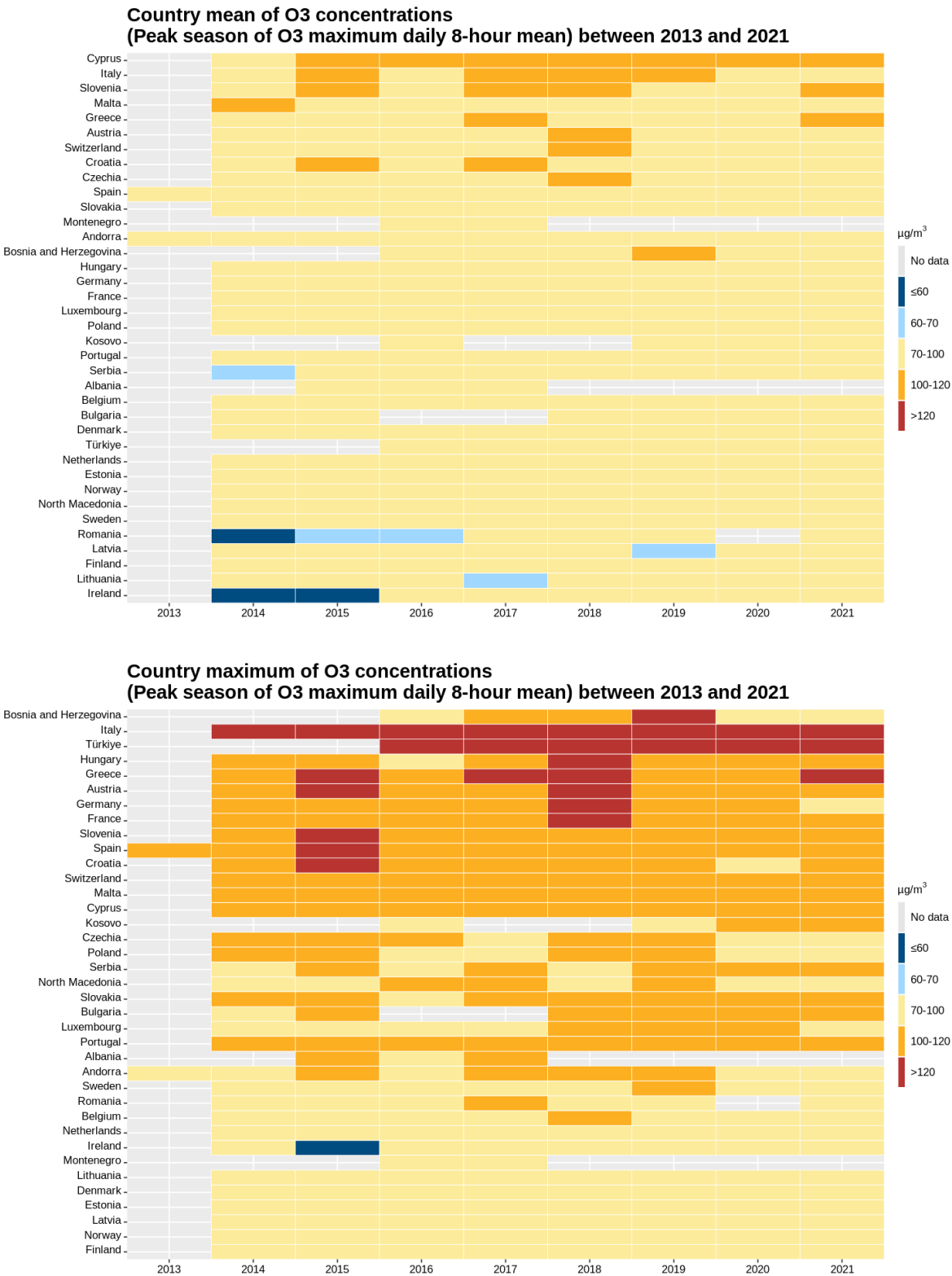
Figure 26 shows the maps of the peak season O<sub>3</sub> concentrations (equivalent to the long-term WHO AQG level) for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

Figure 26: Maps of peak season O<sub>3</sub> concentrations for the last 4 years



Heatmaps with the evolution from 2013 of the mean (top) and the maximum (bottom) peak season O<sub>3</sub> concentrations at country level data are shown in figure 27. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 27: Evolution of mean (top) and maximum (bottom) peak season O<sub>3</sub> concentrations per country from 2013



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

## 5 Status of nitrogen dioxide ambient air concentrations

The reporting countries shown in Figure 1 submitted NO<sub>2</sub> data from 3605 stations for the annual limit value, 3201 stations for the hourly limit value, and 3600 stations for the daily WHO AQG level.

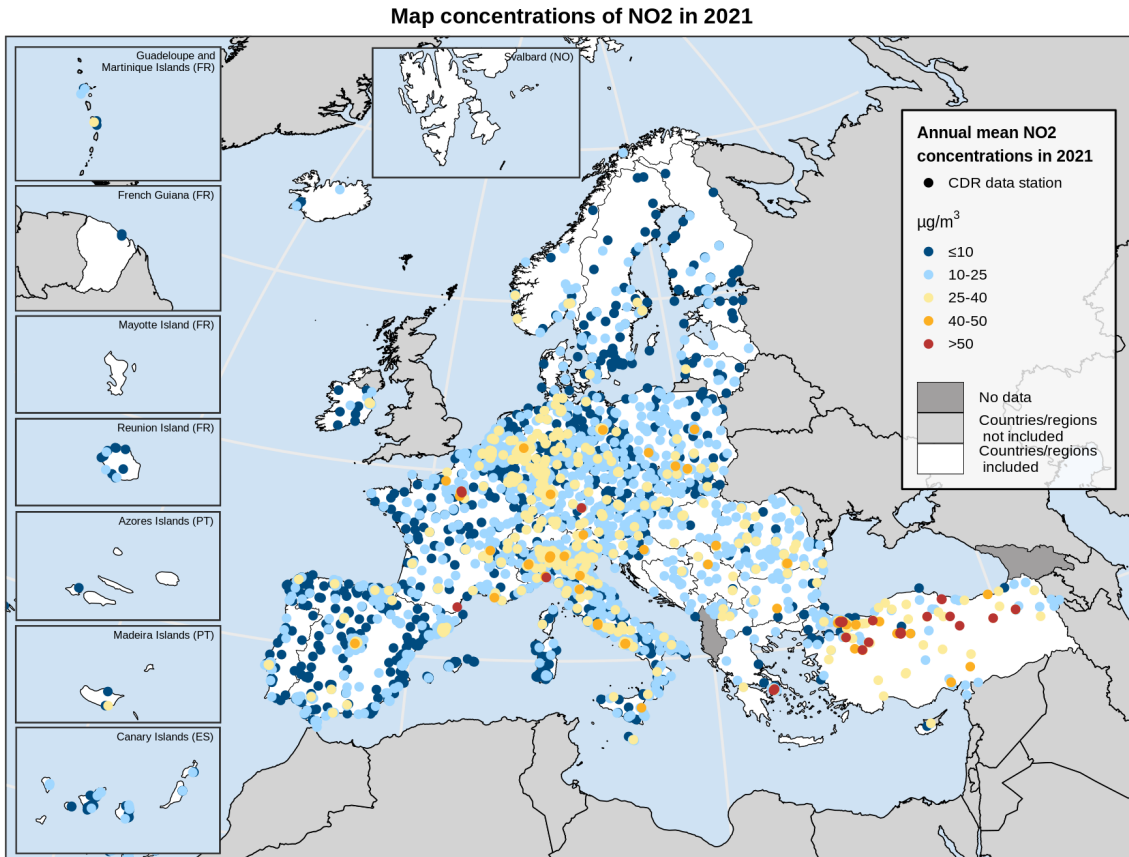
9 of the countries in EU-27 and 2 other reporting countries (Figure 28) recorded concentrations above the annual limit value (40 µg/m<sup>3</sup>). This happened in 3 % of all the stations measuring NO<sub>2</sub>. On the contrary, 75 % of stations, located in 27 of the countries in EU-27 and 10 other reporting countries reported concentrations above the WHO AQG level of 10 µg/m<sup>3</sup>. Figure 28 shows the measured annual mean NO<sub>2</sub> concentrations.

75 % of all values above the annual limit value were observed at traffic stations. Furthermore, 100 % of the stations with concentrations above the annual limit value were located in urban or suburban areas.

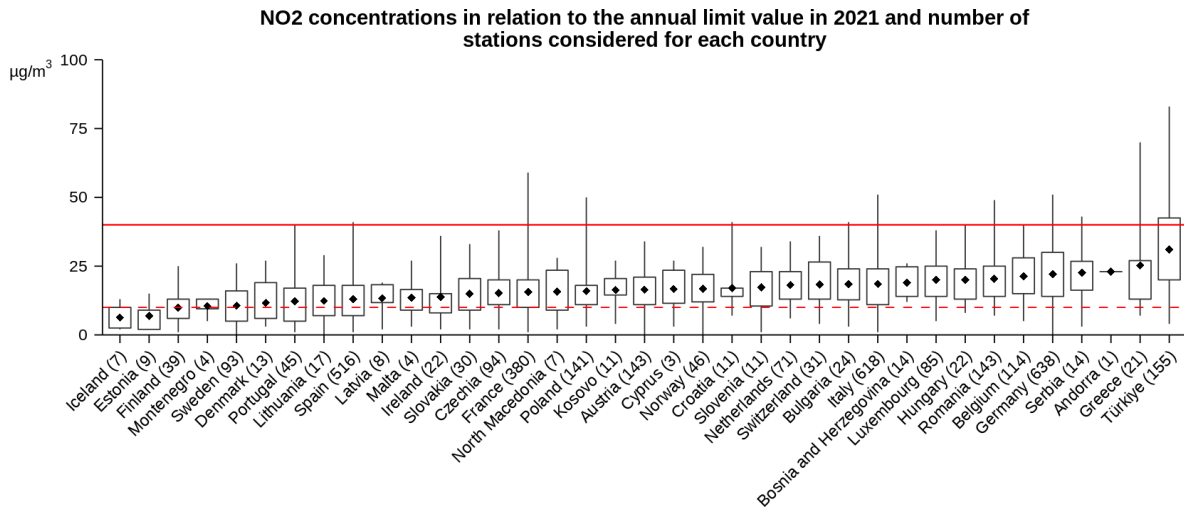
Concentrations above the hourly limit value (200 µg/m<sup>3</sup>) were observed in 0.5 % (16 stations) of all reporting stations, mostly at urban traffic stations. They were observed in one countries (number stations): Türkiye (sixteen).

Finally, concentrations above the daily NO<sub>2</sub> WHO AQG level (25 µg/m<sup>3</sup>) were registered in 77 % (2783 stations) of all the reporting stations in 27 of the countries in EU-27 and 10 other reporting countries (Figure 31).

Figure 28: Map and boxplot of NO<sub>2</sub> concentrations in 2021



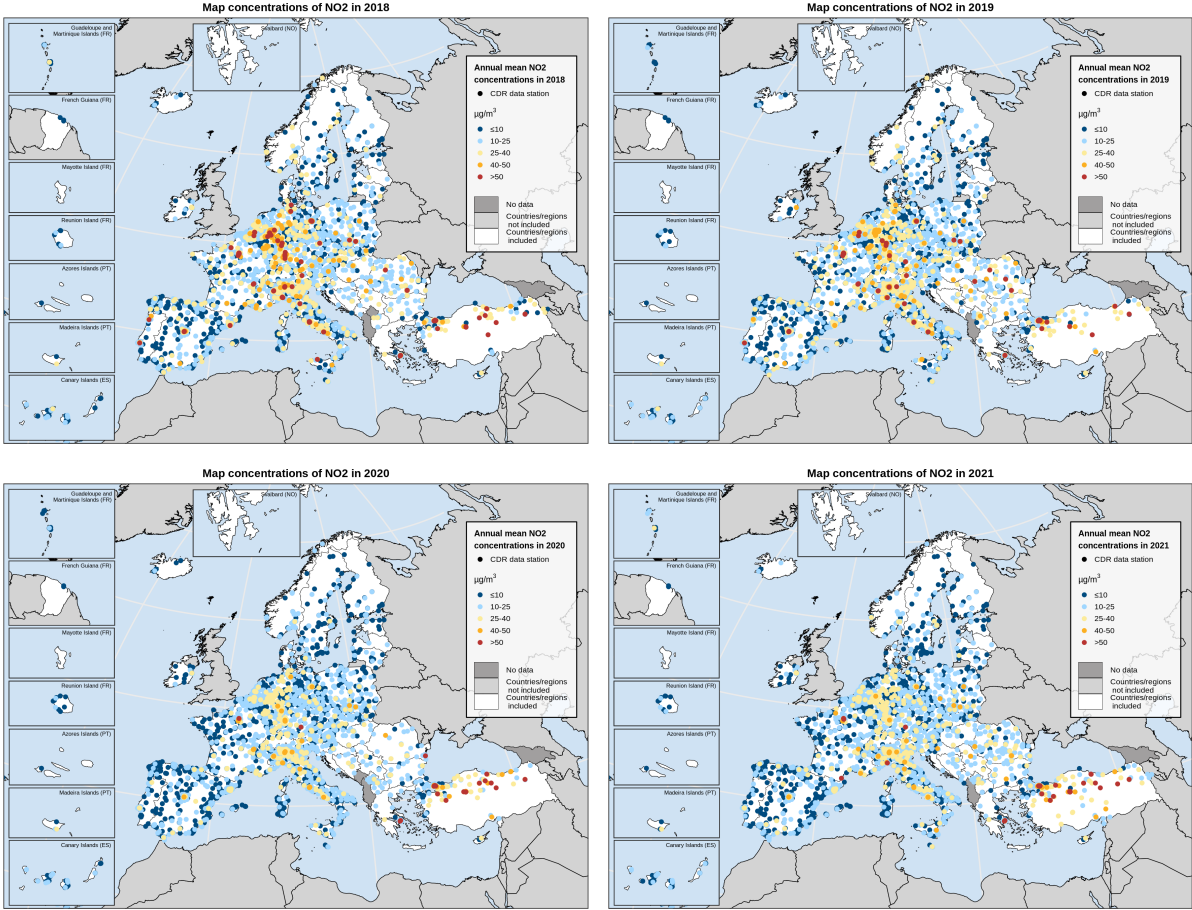
Note: Observed concentrations of NO<sub>2</sub> in 2021. The last two colour categories correspond to values above the EU annual limit value (40 µg/m<sup>3</sup>), while the first colour category indicates stations reporting values below the WHO AQG level for NO<sub>2</sub> (10 µg/m<sup>3</sup>). Only stations with more than 75 % of valid data have been included in the map.



Note: The graph is based on the annual mean concentration values. For each country, the number of stations considered for 2021 (in brackets) are given. The boxplot represents the lowest (bottom of the whisker), highest (top of the whisker) and average (black dot) annual mean values (in µg/m<sup>3</sup>). The rectangles mark the 25th and 75th percentiles. At 25 % of the stations, levels are below the 25th percentile; at 25 % of the stations, concentrations are above the 75th percentile. The limit value set by EU legislation is marked by the horizontal line. The WHO AQG level is marked by the lower dashed horizontal line. The graph should be read in relation to the above map, as a country's situation depends on the number of stations considered.

Figure 29 shows the maps of the observed NO<sub>2</sub> annual mean concentrations for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

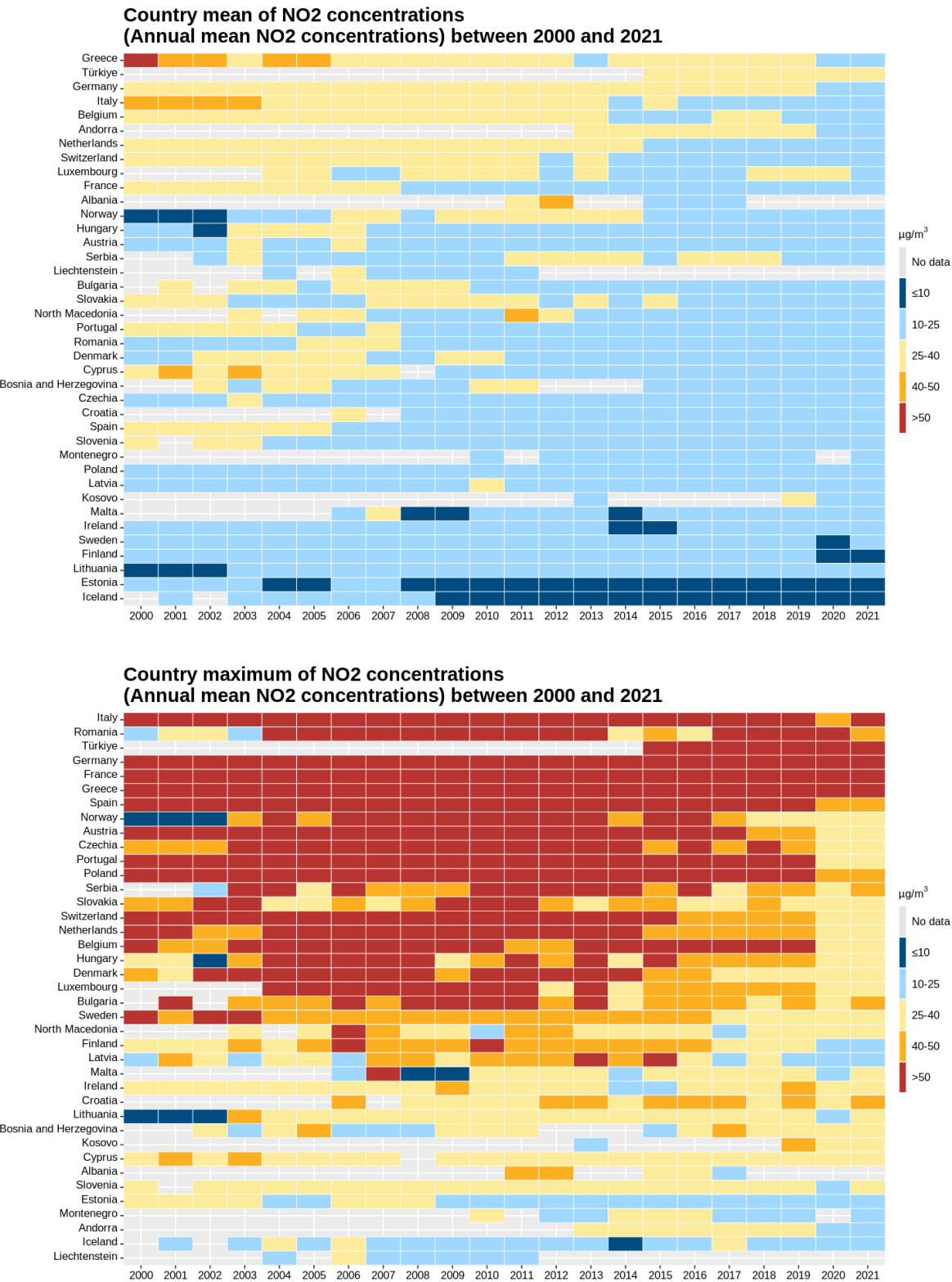
Figure 29: Map of NO<sub>2</sub> concentrations (annual mean) for the last 4 years



Maps for years before 2020 are different to the ones published in previous reports because the bands in the legend have been modified to accommodate the 2021 WHO AQG level.

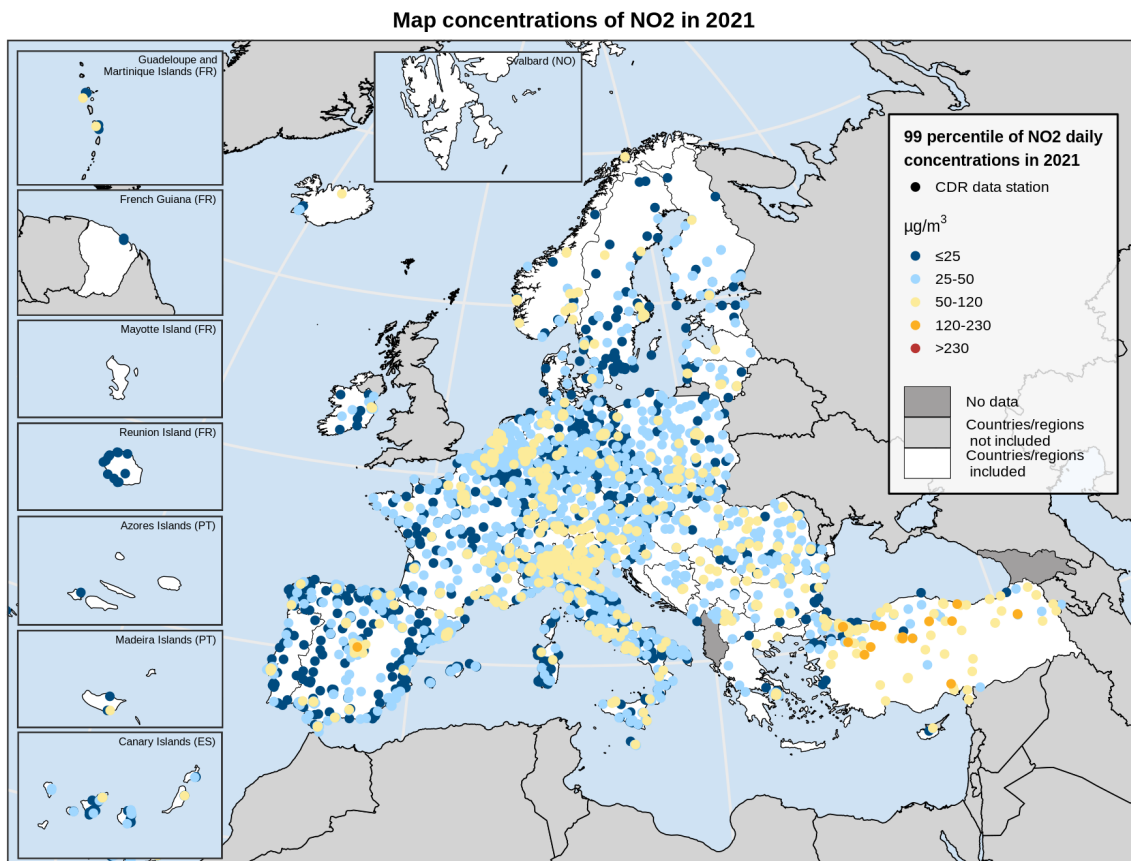
Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) NO<sub>2</sub> annual mean concentrations at country level are shown in figure 30. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 30: Evolution of mean (top) and maximum (bottom) NO<sub>2</sub> annual mean concentrations (annual limit value) per country from 2000



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

Figure 31: Map of NO<sub>2</sub> concentrations in 2021 - daily WHO AQG level

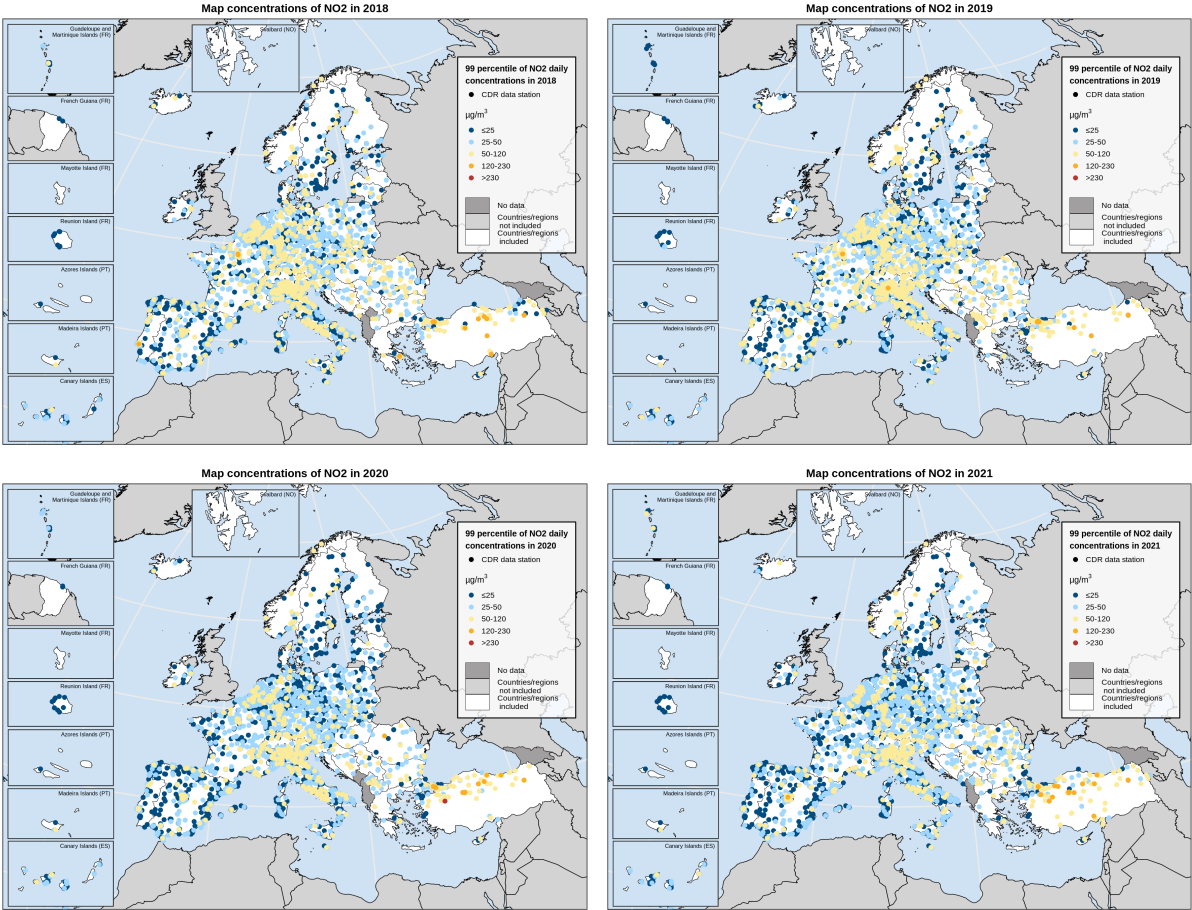


Note: Observed concentrations of NO<sub>2</sub> in 2021. The map shows the 99 percentile of the NO<sub>2</sub> daily mean concentrations, equivalent to 3–4 exceedance days per year, according to the definition of the daily WHO AQG level (25 µg/m<sup>3</sup>). The first colour category indicates stations with concentrations below this AQG level. Only stations with more than 75 % of valid data have been included in the map.



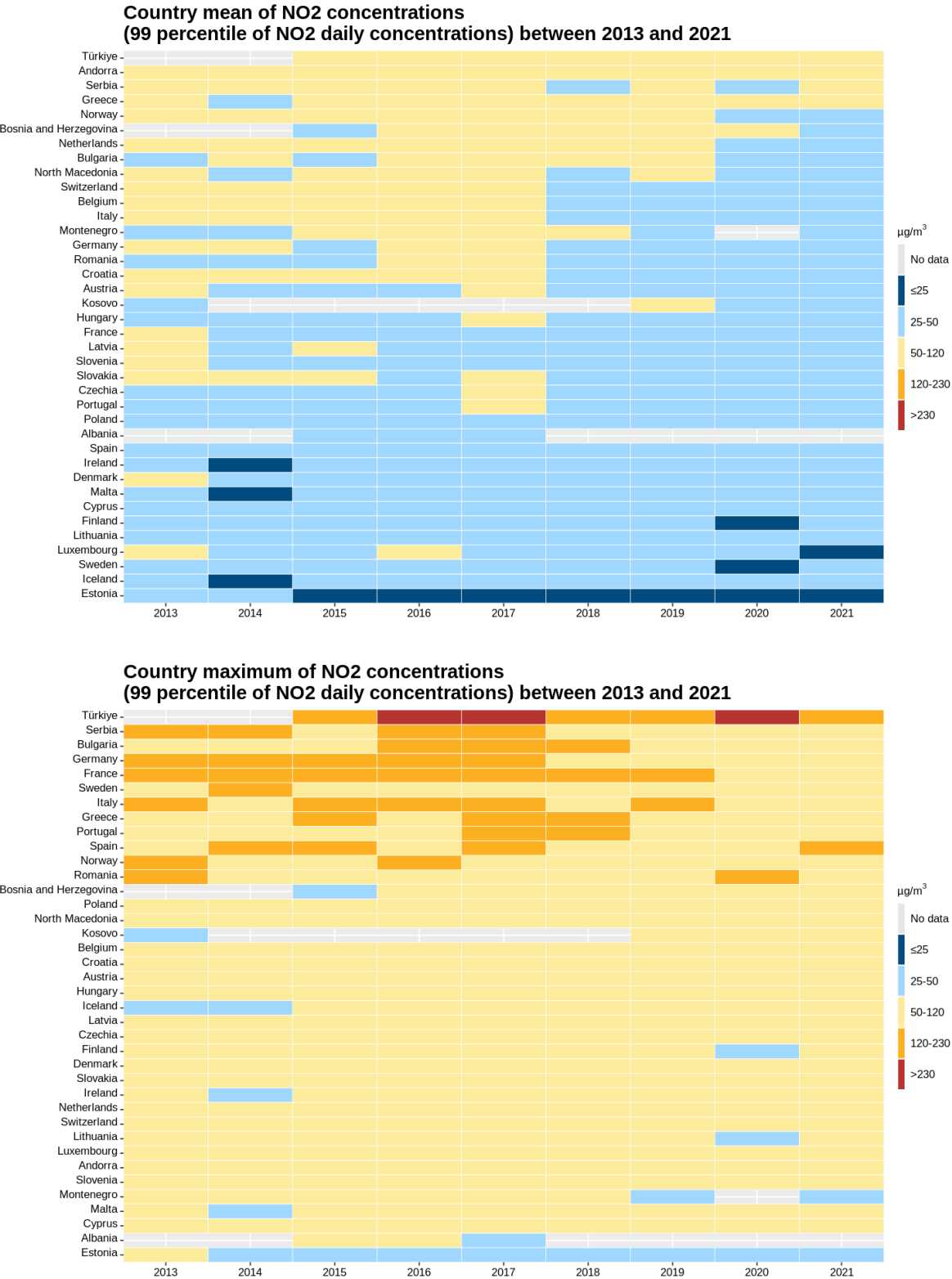
Figure 32 shows the maps of the 99 percentile of NO<sub>2</sub> daily mean concentrations (equivalent to the WHO AQG level for NO<sub>2</sub> daily mean level) for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

Figure 32: Maps of NO<sub>2</sub> concentrations (daily WHO AQG level) for the last 4 years



Heatmaps with the evolution from 2013 of the mean (top) and the maximum (bottom) 99 percentile of NO<sub>2</sub> daily mean concentrations at country level are shown in figure 33. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 33: Evolution of mean (top) and maximum (bottom) 99 percentile of NO<sub>2</sub> daily mean concentrations (daily WHO AQG level) per country from 2013



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

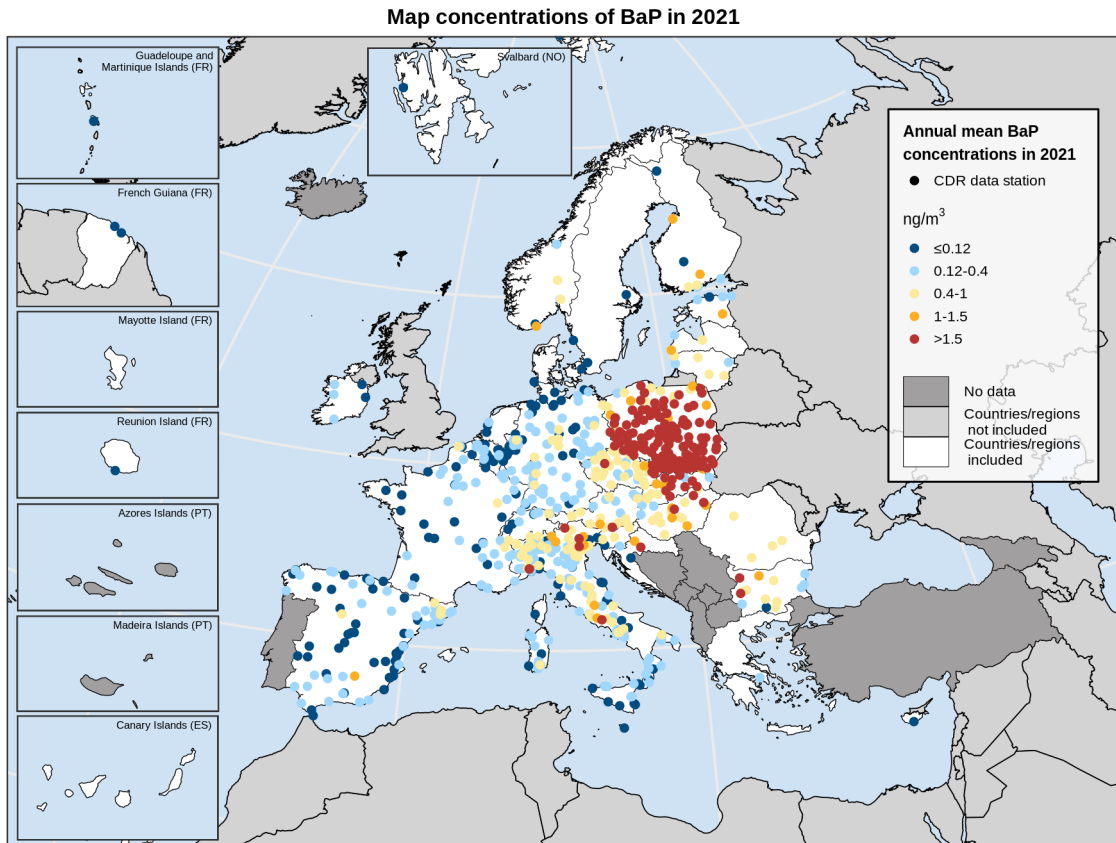
## 6 Status of benzo[a]pyrene ambient air concentrations

A total of 794 stations in the reporting countries shown in Figure 1 reported BaP data with sufficient data coverage.

13 countries measured concentrations above  $1.0 \text{ ng/m}^3$  (Figure 34). These were measured at 27 % of the reported BaP measurement stations (Figure 34), mainly at urban (78 % of all stations with values above  $1.0 \text{ ng/m}^3$ ) and suburban (17 %) stations.

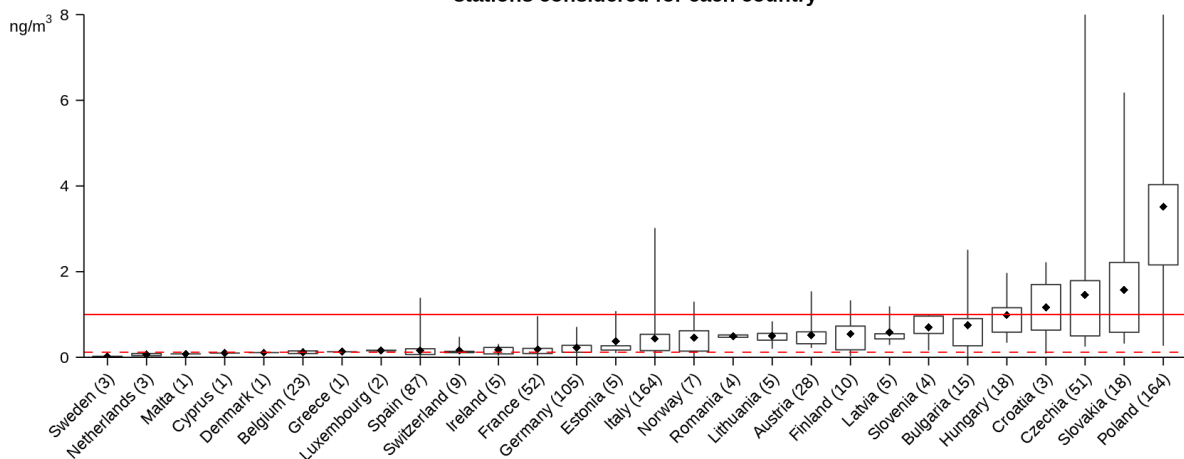
Regarding the reference level, all reporting countries, except for Cyprus, Denmark, Malta and Sweden have at least one station with concentrations above  $0.12 \text{ ng/m}^3$ . Only 19 % of the reported stations had annual concentrations below the reference level.

Figure 34: Map and boxplot of BaP concentrations in 2021



Note: Observed concentrations of BaP in 2021. The first colour category correspond to concentrations under the estimated reference RL (0.12 ng/m<sup>3</sup>). The last colour category correspond to concentrations exceeding the 2004 Ambient Air Quality Directive target value of 1 ng/m<sup>3</sup>. Only stations reporting more than 13 % of valid data, as daily, weekly or monthly measurements, have been included in the map.

BaP concentrations in relation to the annual limit value in 2021 and number of stations considered for each country

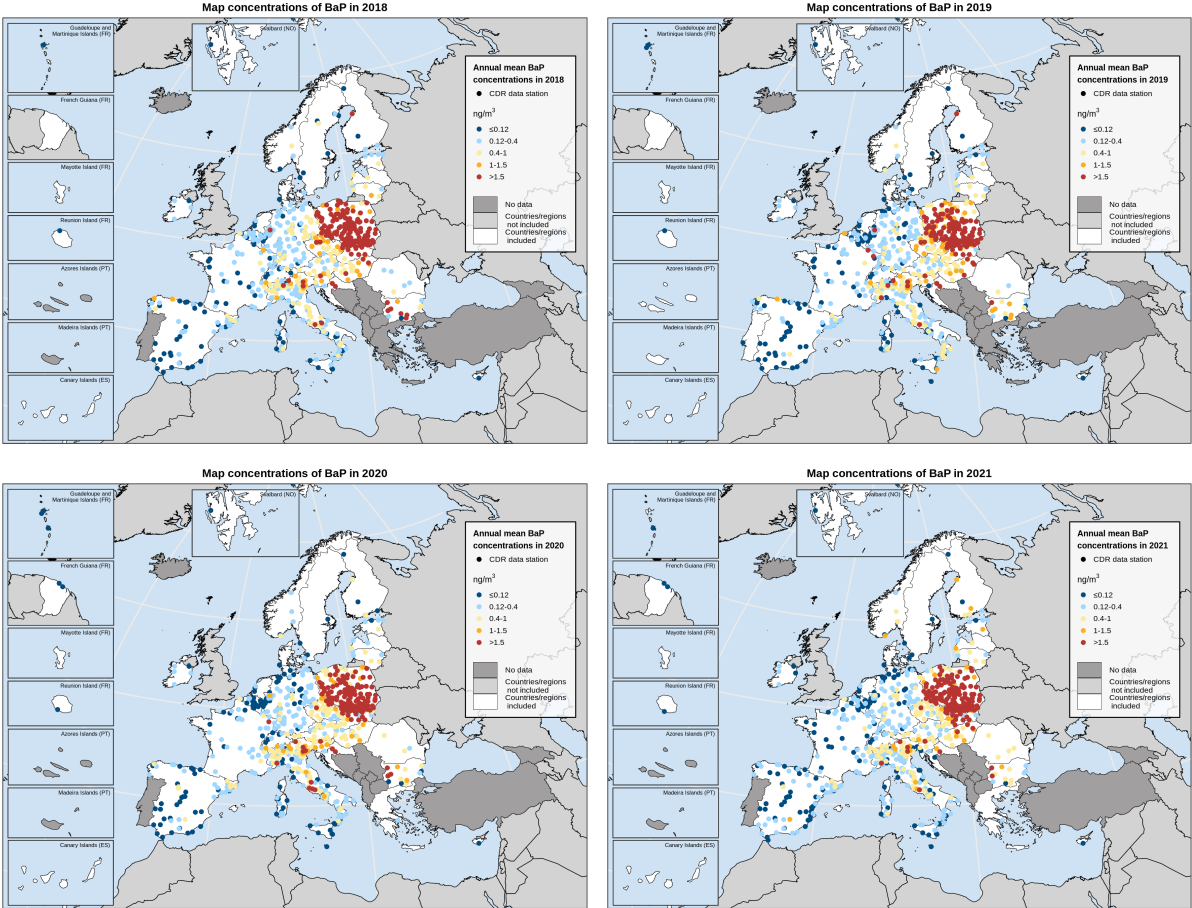


Note: The graph is based on the annual mean concentration values. For each country, the number of stations considered for 2021 (in brackets) are given. The boxplot represents the lowest (bottom of the whisker), highest (top of the whisker) and average (black dot) annual mean values (in ng/m<sup>3</sup>). The rectangles mark the 25th and 75th percentiles. At 25 % of the stations, levels are below the 25th percentile; at 25 % of the stations, concentrations are above the 75th percentile. The upper horizontal line marks the concentration of 1.0 ng/m<sup>3</sup>. The lower horizontal line marks the estimated air quality RL. The graph should be read in relation to the above map, as a country's situation depends on the number of stations considered.

The highest value in the boxplot, Poland (15 ng/m<sup>3</sup>), has not been included in the graph for representation purposes.

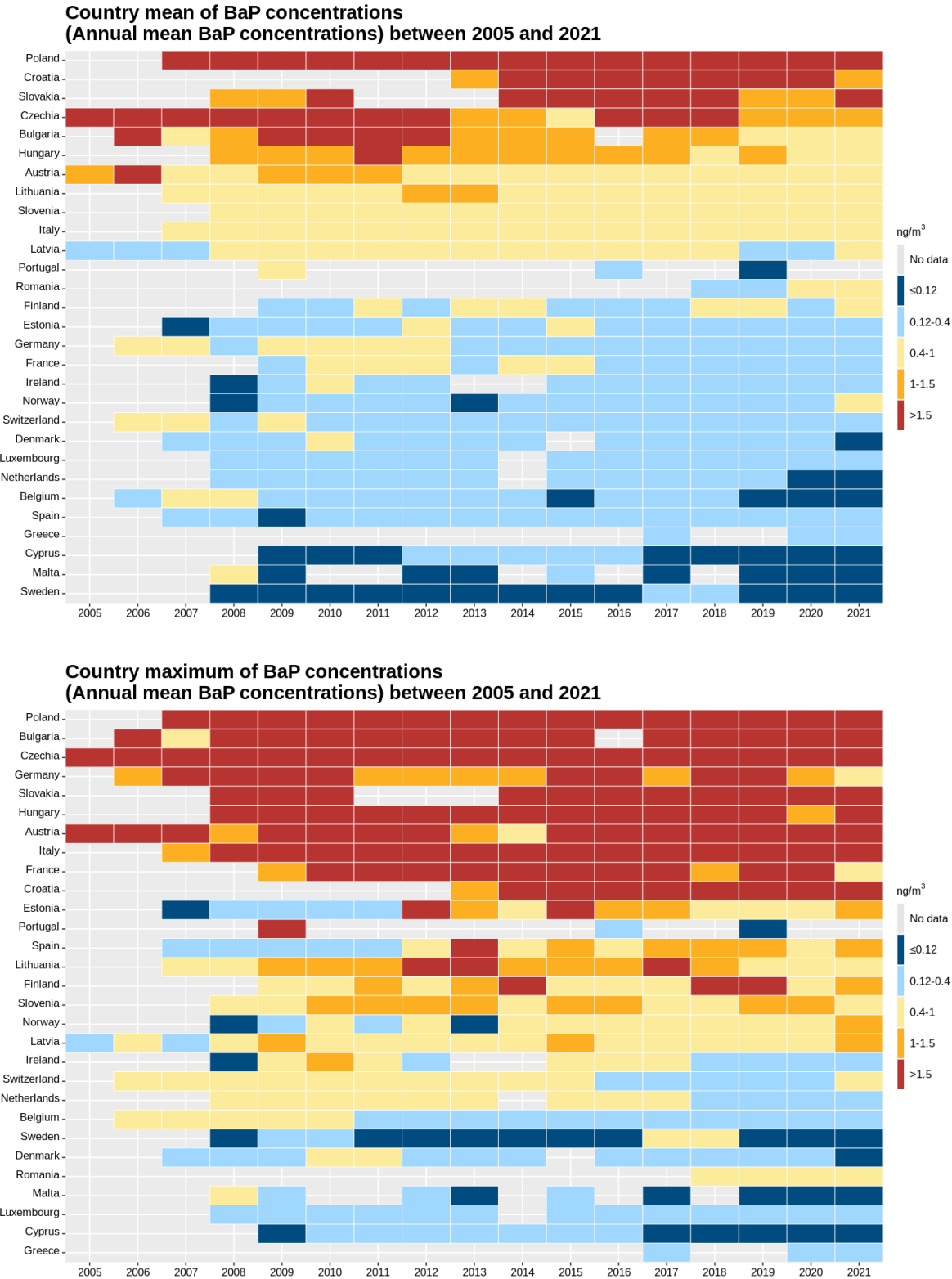
Figure 35 shows the maps of the observed BaP annual mean concentrations for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

Figure 35: Maps of BaP concentrations (annual mean) for the last 4 years



Heatmaps with the evolution from 2005 of the mean (top) and the maximum (bottom) BaP annual mean concentrations at country level are shown in figure 36. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 36: Evolution of mean (top) and maximum (bottom) BaP annual mean concentrations (target value) per country from 2005



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

## 7 Status of sulphur dioxide, carbon monoxide, benzene and toxic metals ambient air concentrations

### 7.1 Sulphur dioxide

The reporting countries shown in Figure 1 reported measurements of SO<sub>2</sub> from 1692 stations for the hourly limit value and 1716 stations for the daily limit value.

19 stations <sup>(7)</sup> registered concentrations above the hourly limit value (350 µg/m<sup>3</sup>); and 19 stations <sup>(8)</sup> registered concentrations above the daily limit of 125 µg/m<sup>3</sup> for SO<sub>2</sub> (Figure 37).

On the contrary, 110 (6 %) of all the stations reporting SO<sub>2</sub> levels, located in 19 reporting countries <sup>(9)</sup>, measured SO<sub>2</sub> concentrations above the WHO AQG level of 40 µg/m<sup>3</sup> for daily mean concentrations <sup>(10)</sup>.

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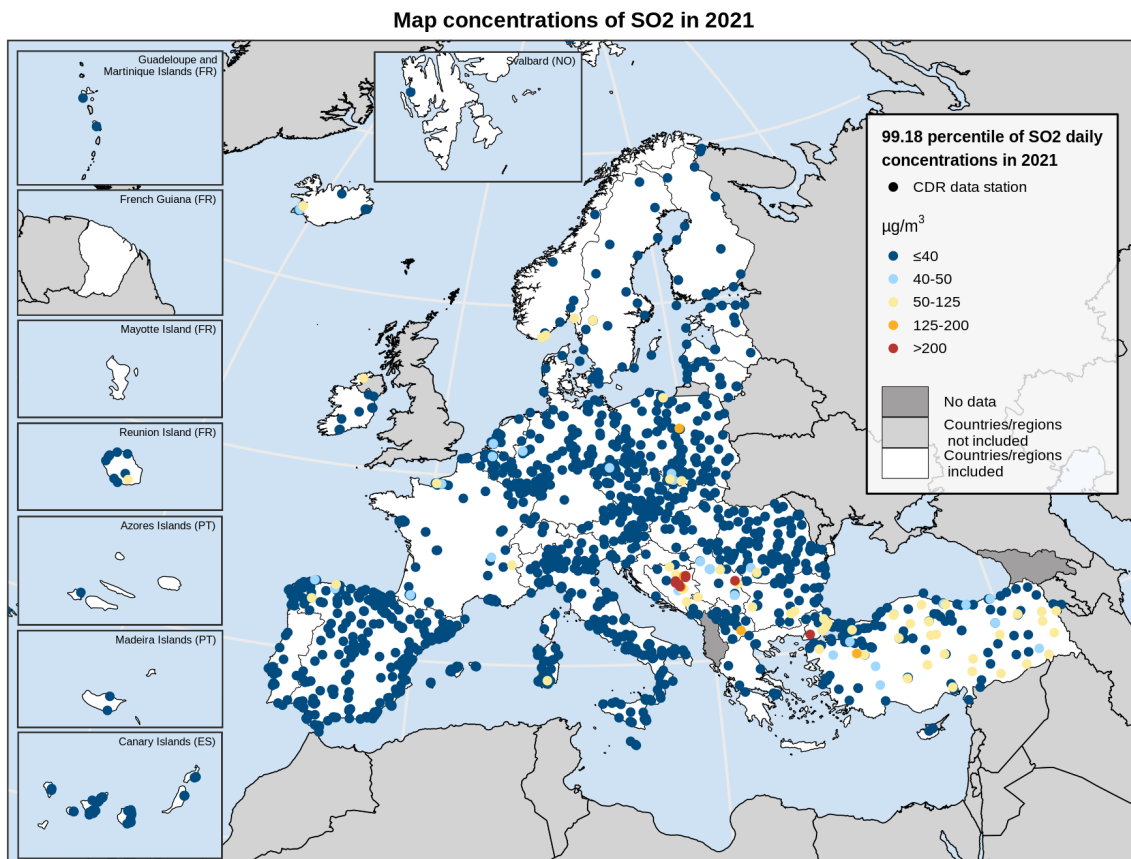
<sup>7</sup>Bosnia and Herzegovina (eleven), Türkiye (three), Serbia (two), Bulgaria (one), North Macedonia (one) and Poland (one)

<sup>8</sup>Bosnia and Herzegovina (twelve), Türkiye (three), Serbia (two), North Macedonia (one) and Poland (one).

<sup>9</sup>All reporting countries except Andorra, Austria, Croatia, Cyprus, Denmark, Estonia, Finland, Greece, Hungary, Kosovo, Latvia, Lithuania, Luxembourg, Malta, Portugal, Slovakia, Slovenia and Switzerland.

<sup>10</sup>Although the WHO AQG level for daily means refers to the percentile 99 (3-4 exceedance days), here we have used the percentile 99.18 (3 exceedance days), so the daily WHO AQG level can be directly compared with the EU daily LV.

Figure 37: Map of SO<sub>2</sub> daily concentrations in 2021

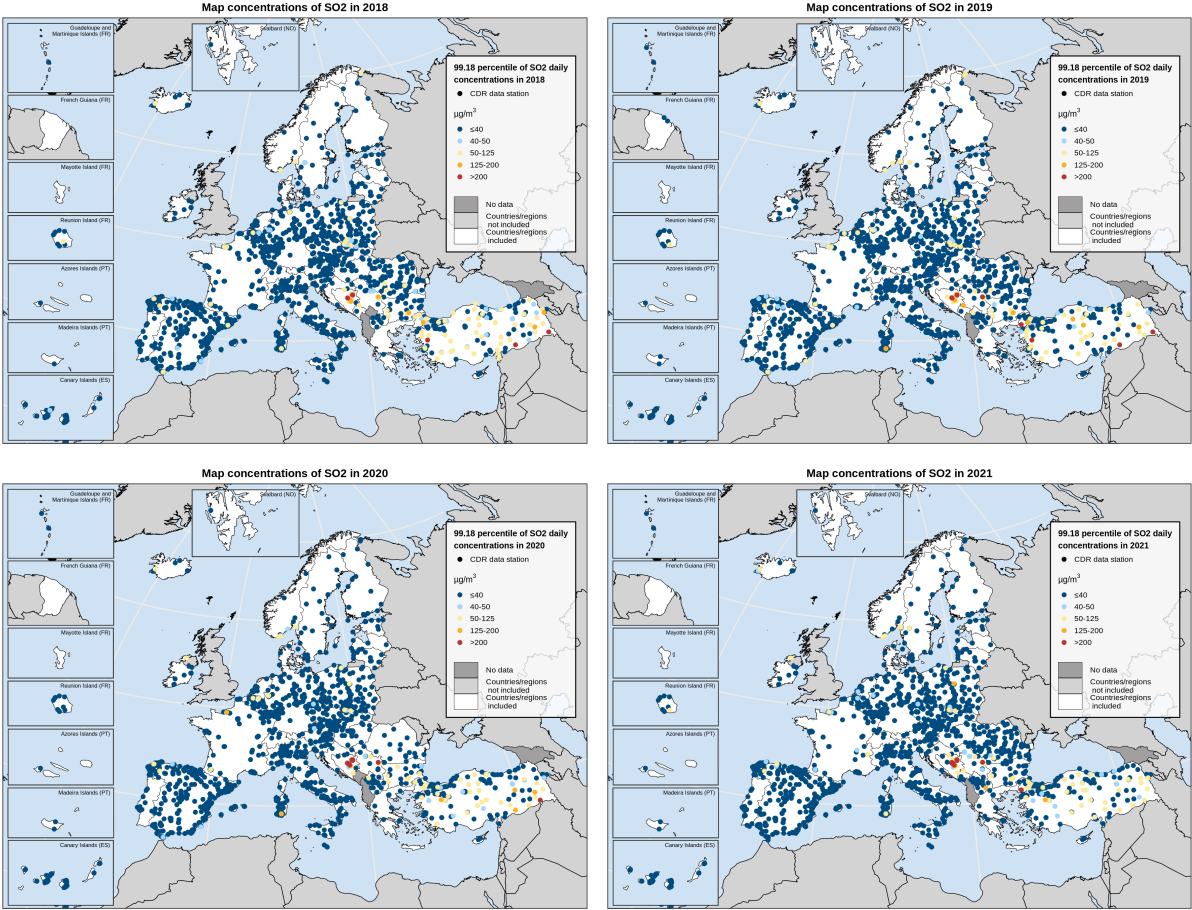


Note: Observed concentrations of SO<sub>2</sub> in 2021. The map shows the percentile 99.18 of SO<sub>2</sub> daily means, indicating 3 exceedance days. It relates to the EU daily limit value (125 µg/m<sup>3</sup>) and to the WHO daily AQG level (40 µg/m<sup>3</sup>). Only stations with more than 75 % of valid data have been included in the map.



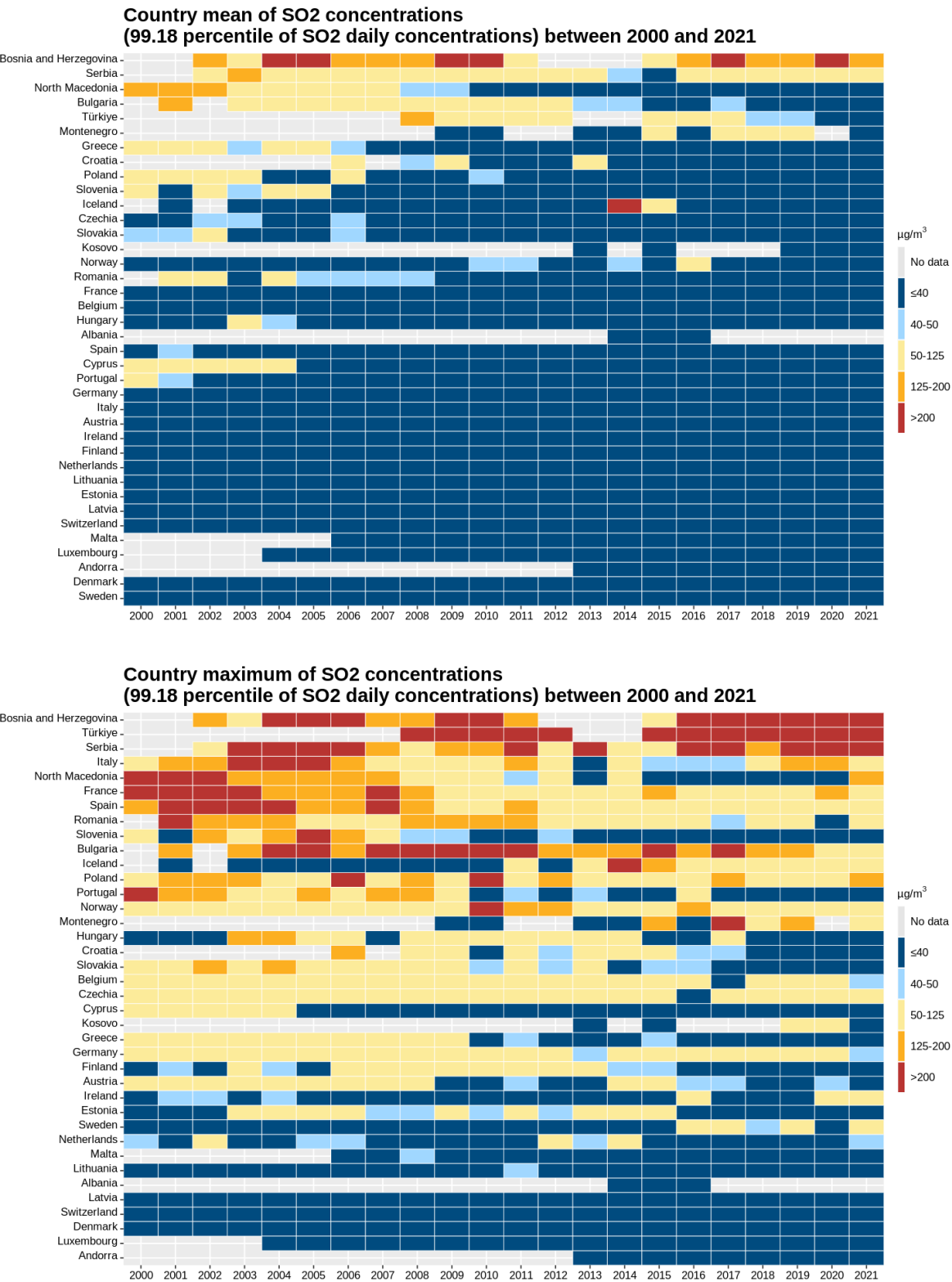
Figure 38 shows the maps of the observed SO<sub>2</sub> daily mean concentrations for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

Figure 38: Maps of SO<sub>2</sub> concentrations (daily mean) for the last 4 years



Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) SO<sub>2</sub> daily mean concentrations at country level are shown in figure 39. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 39: Evolution of mean (top) and maximum (bottom) SO<sub>2</sub> 99.18 percentile of daily mean concentrations (EU LV (125 µg/m<sup>3</sup>) and WHO AQG level (40 µg/m<sup>3</sup>)) per country from 2000



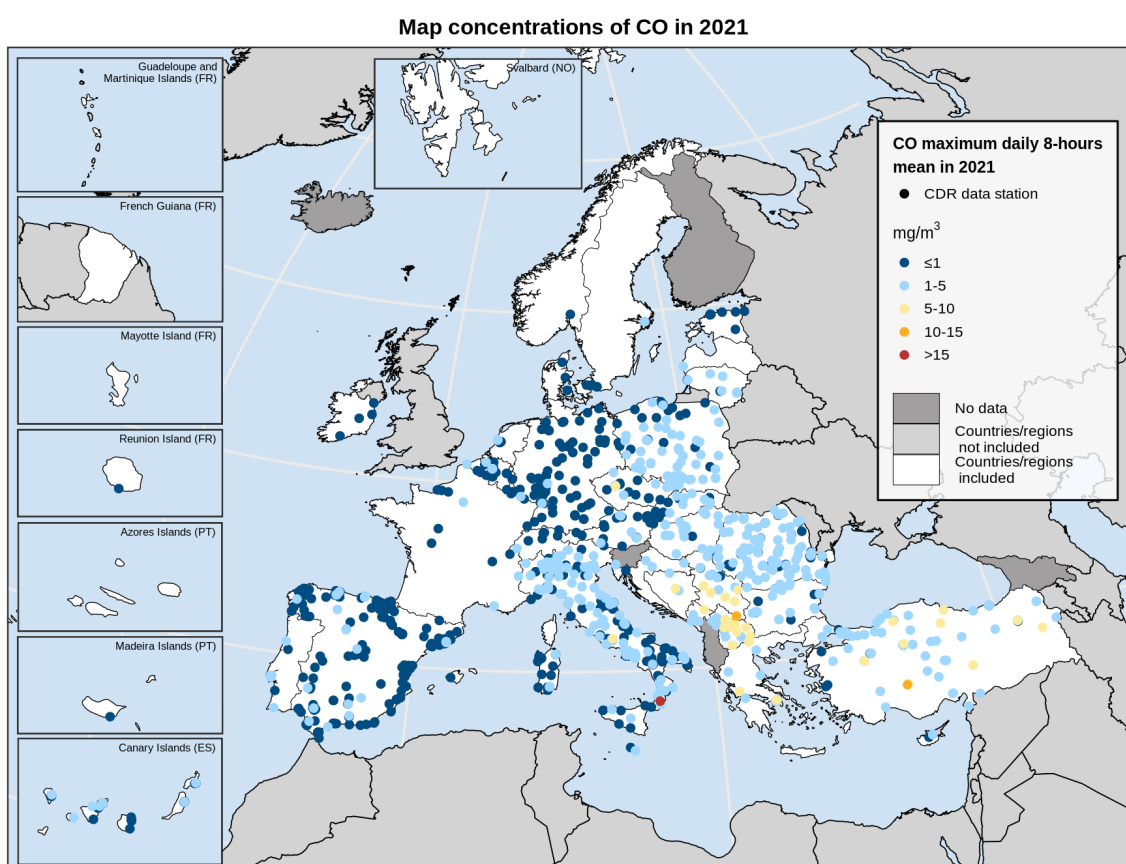
Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

## 7.2 Carbon monoxide

All reporting countries shown in Figure 1 measured CO data from 1038 operational stations for the daily limit value and from 1039 stations for the daily WHO AQG level. Only 4 stations (Figure 40) registered concentrations above the CO limit daily value ( $10 \text{ mg/m}^3$ ) and the WHO AQG level for the maximum daily 8-hour mean. These stations were located in Italy (two), Serbia (one) and Türkiye (one).

2 stations registered concentrations above the daily WHO AQG level ( $4 \text{ mg/m}^3$ ). They were located in Kosovo (one) and Türkiye (one) (Figure 42).

Figure 40: Map of CO concentrations in 2021

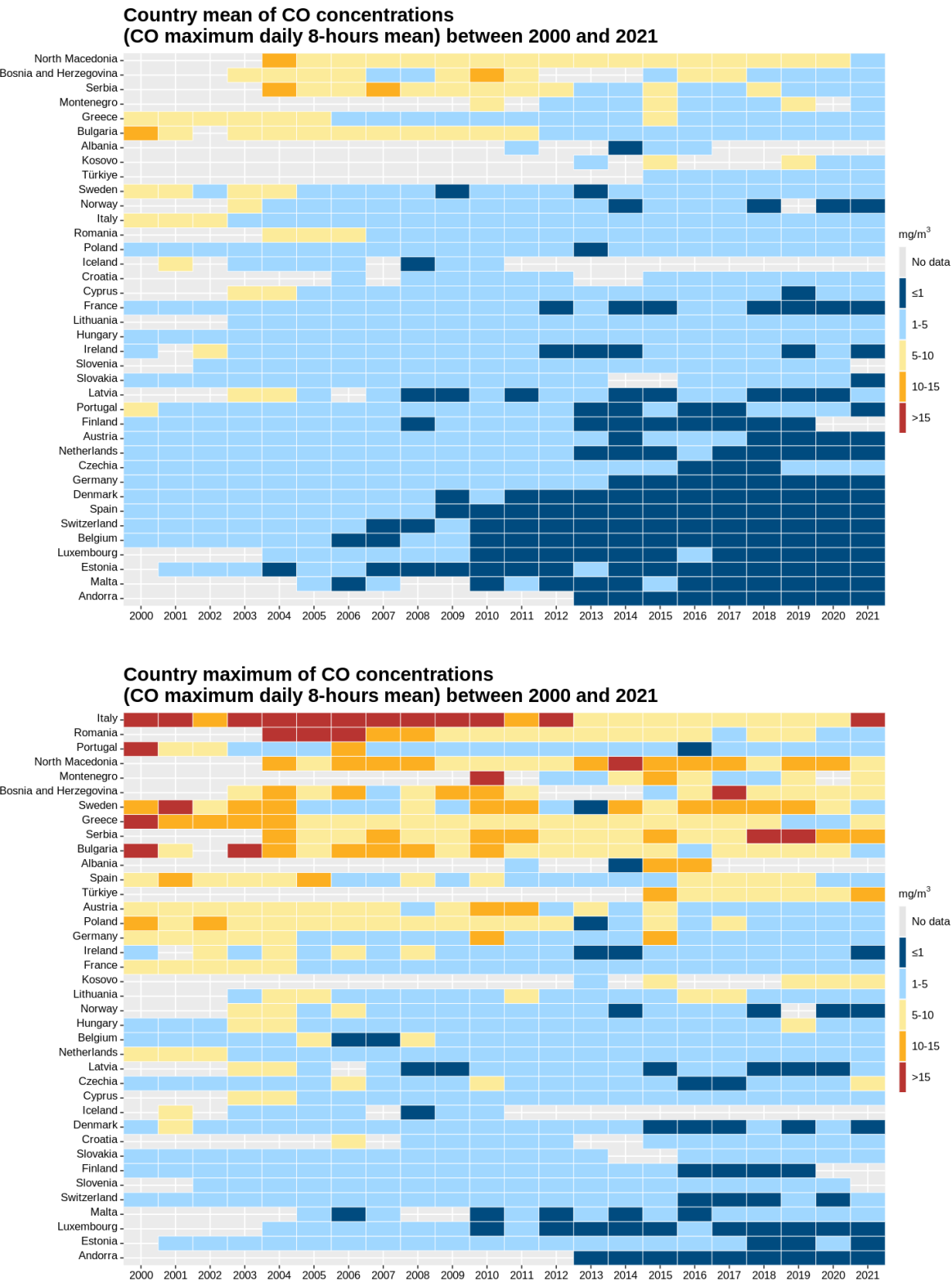


Note: Observed concentrations of CO in 2021. The map shows the CO maximum daily 8-hour mean. The last two colour categories correspond to values above the EU annual limit value and the WHO AQG ( $10 \text{ mg/m}^3$ ). Only stations with more than 75 % of valid data have been included in the map.

When concentrations are below the 'lower assessment threshold' (LAT), air quality can be assessed by means of only modelling or objective estimates. At 1003 stations (97 % of locations), maximum daily 8-hour mean concentrations of CO were below the LAT of  $5 \text{ mg/m}^3$  (first two colour categories in Figure 40).

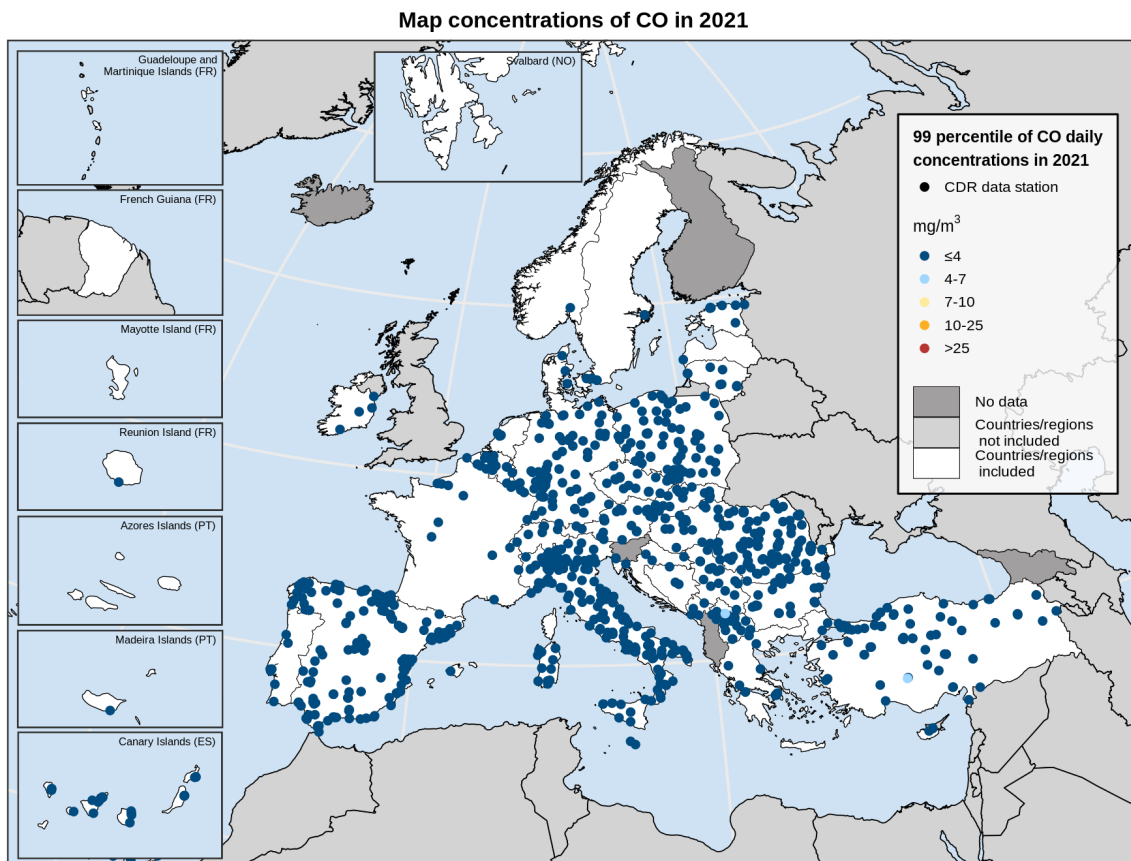
Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) CO maximum daily 8-hour mean concentrations at country level are shown in Figure 41. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 41: Evolution of mean (top) and maximum (bottom) CO maximum daily 8-hour mean concentrations (limit value) per country from 2000



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

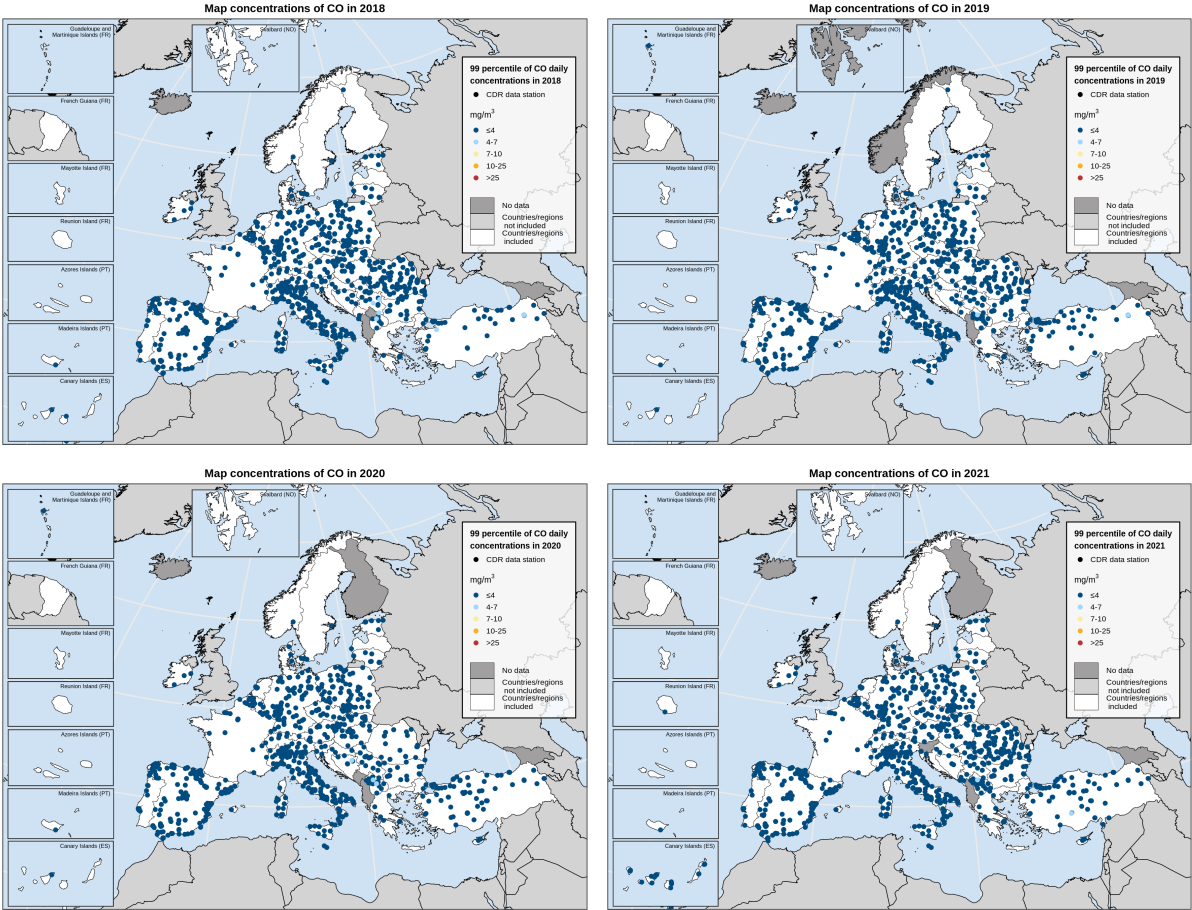
Figure 42: Map of daily CO concentrations in 2021



Note: Observed concentrations of CO in 2021. The map shows the 99 percentile of CO daily concentrations, meaning 3–4 exceedance days. The first colour category corresponds to values below the WHO AQG level (4 mg/m<sup>3</sup>). Only stations with more than 75 % of valid data have been included in the map.

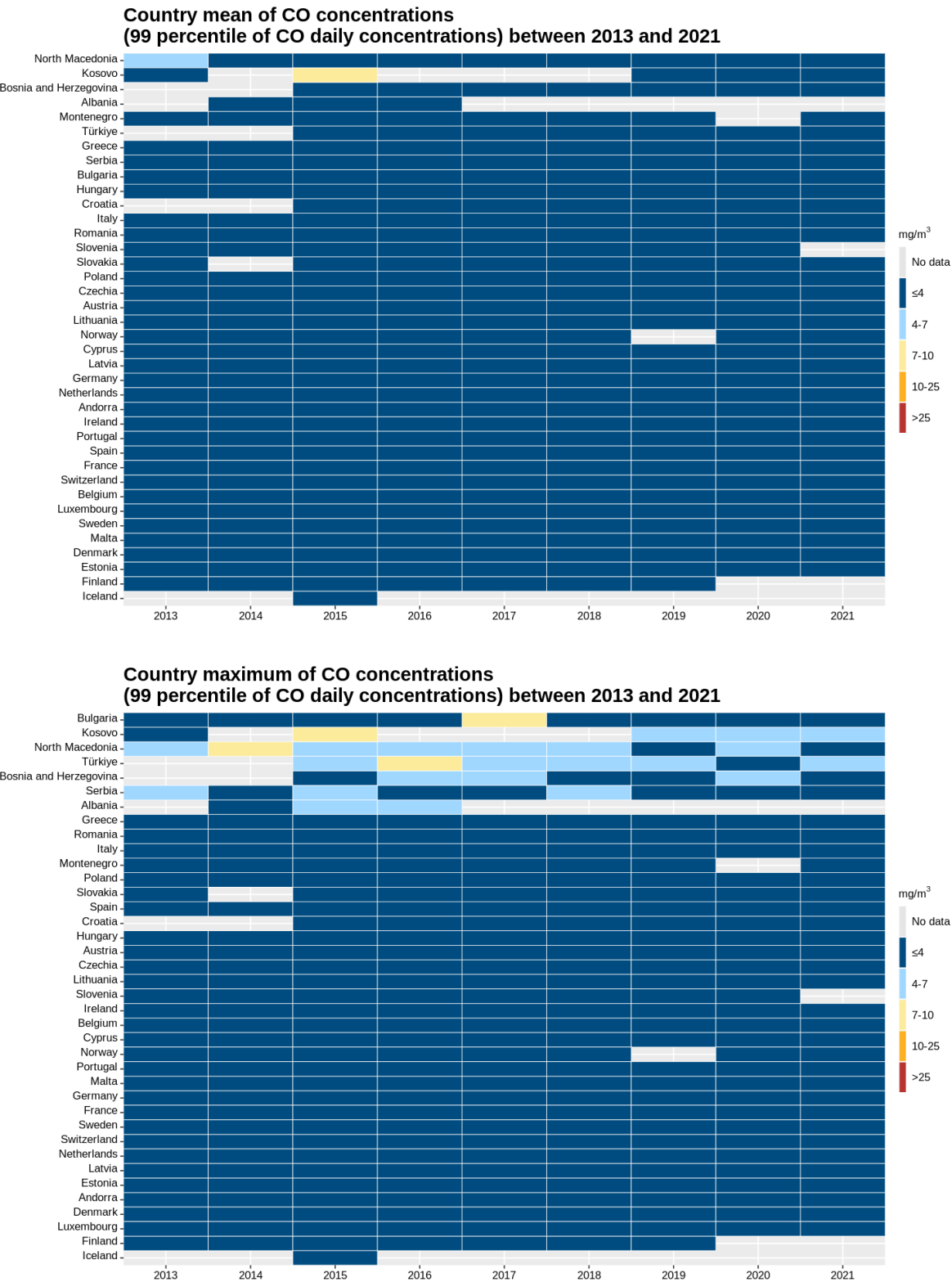
Figure 43 shows the maps of the 99 percentile of CO daily mean concentrations (equivalent to the WHO AQG for CO daily mean level) for the last four years. In this way, any significant change in the spatial distribution of the values above the set thresholds in the legends can be observed. These maps are based on officially reported validated data (CDR).

Figure 43: Maps of CO concentrations (daily WHO AQG level) for the last 4 years



Heatmaps with the evolution from 2013 of the mean (top) and the maximum (bottom) 99 percentile of CO daily mean concentrations data station at country level are shown in figure 44. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 44: Evolution of mean (top) and maximum (bottom) 99 percentile of CO daily mean concentrations (daily WHO AQG level) per country from 2013



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.



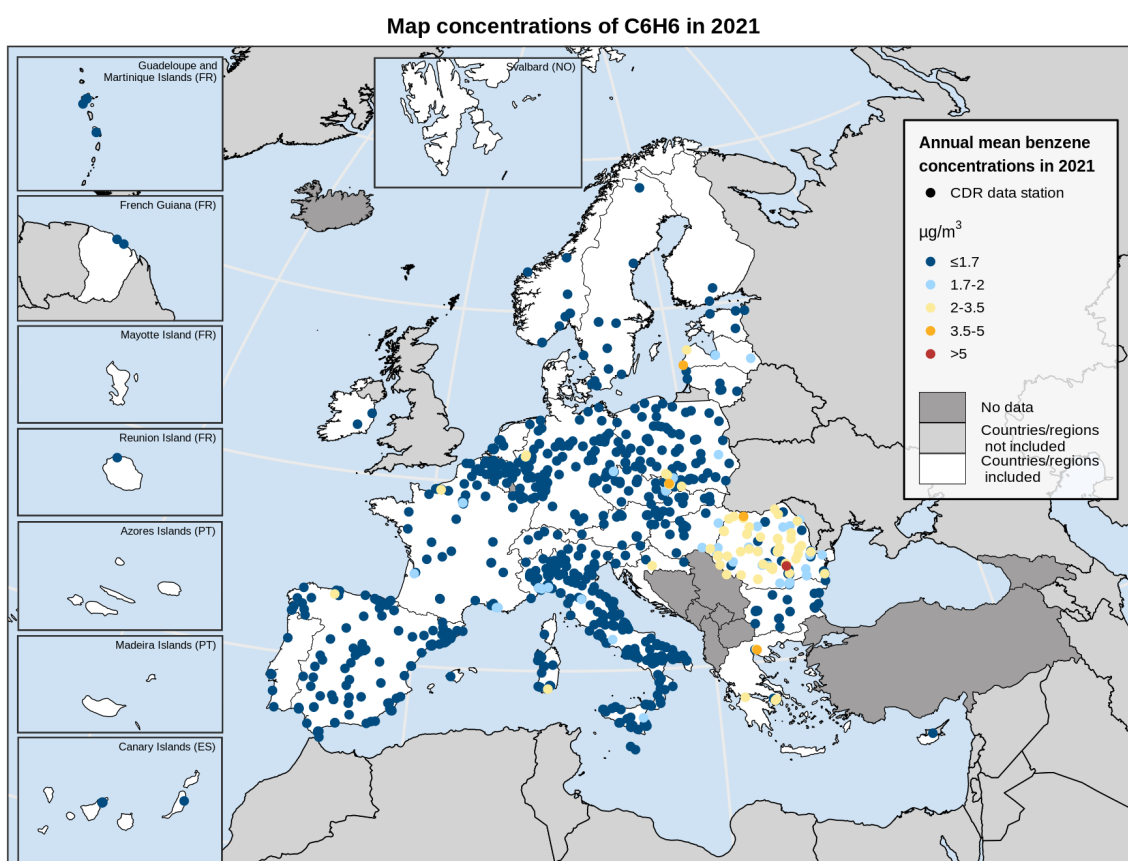
### 7.3 Benzene

C<sub>6</sub>H<sub>6</sub> measurements were reported from a total of 908 stations in the reporting countries shown in Figure 1.

Concentrations above the limit value for C<sub>6</sub>H<sub>6</sub> (5 µg/m<sup>3</sup>) were observed at only 1 stations located in: Romania (one). At 92 % of locations, annual mean concentrations of C<sub>6</sub>H<sub>6</sub> were below the LAT of 2 µg/m<sup>3</sup> (first two colour categories in Figure 45).

Regarding the estimated WHO reference level (1.7 µg/m<sup>3</sup>), 14 % of all stations reported concentrations above this reference level, distributed across 11 European countries <sup>(11)</sup> (Figure 45).

Figure 45: Map of C<sub>6</sub>H<sub>6</sub> concentrations in 2021

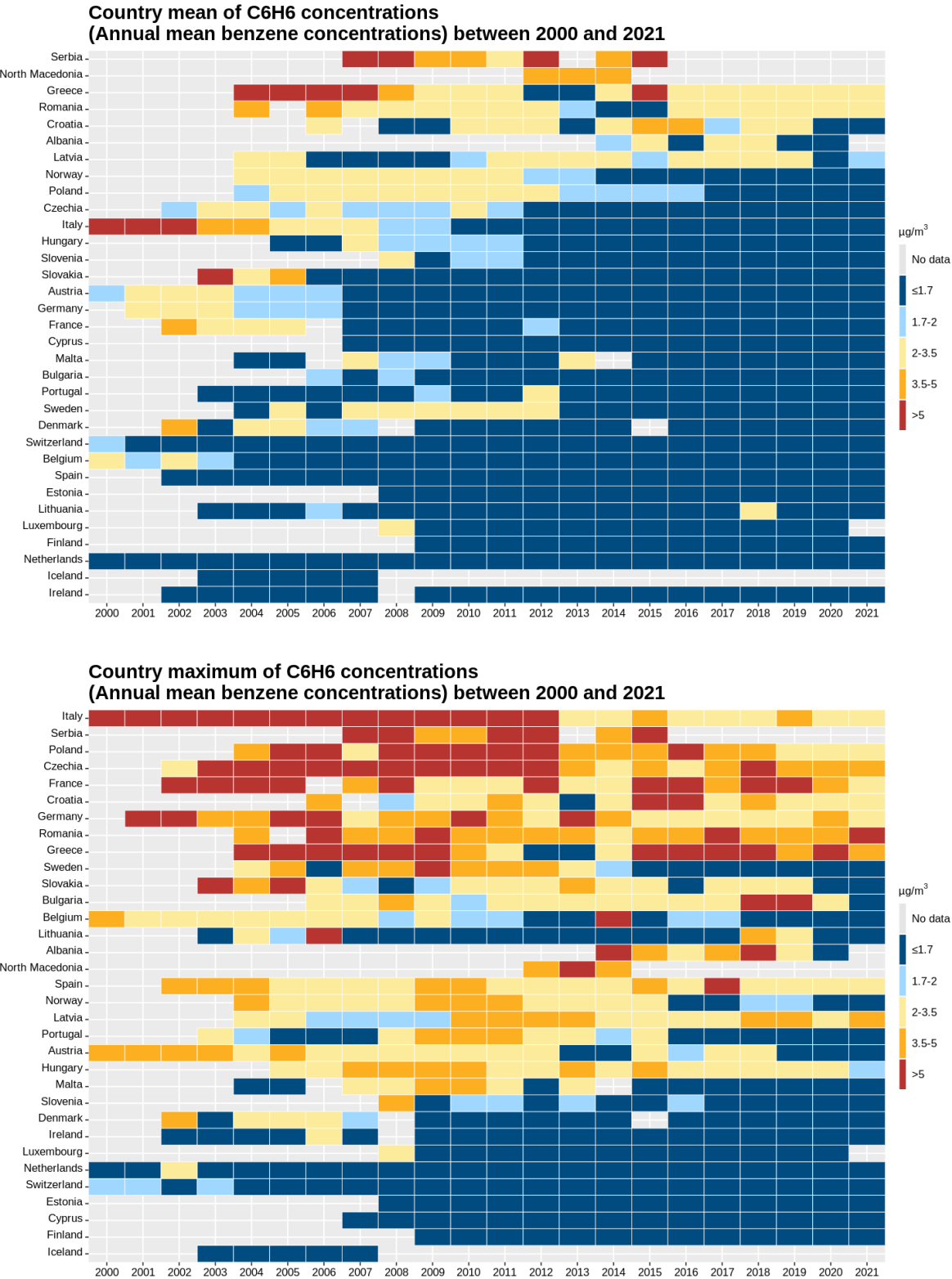


Note: Observed concentrations of C<sub>6</sub>H<sub>6</sub> in 2021. The last colour category correspond to concentrations above the limit value of 5 µg/m<sup>3</sup>. The first colour category correspond to concentrations under the estimated WHO RL (1.7 µg/m<sup>3</sup>). Only stations reporting more than 50 % of valid data have been included in the map.

<sup>11</sup>Croatia, Czechia, France, Germany, Greece, Hungary, Italy, Latvia, Poland, Romania and Spain

Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) C<sub>6</sub>H<sub>6</sub> annual mean concentrations at country level are shown in Figure 46. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 46: Evolution of mean (top) and maximum (bottom) C<sub>6</sub>H<sub>6</sub> annual mean concentrations (limit value) per country from 2000

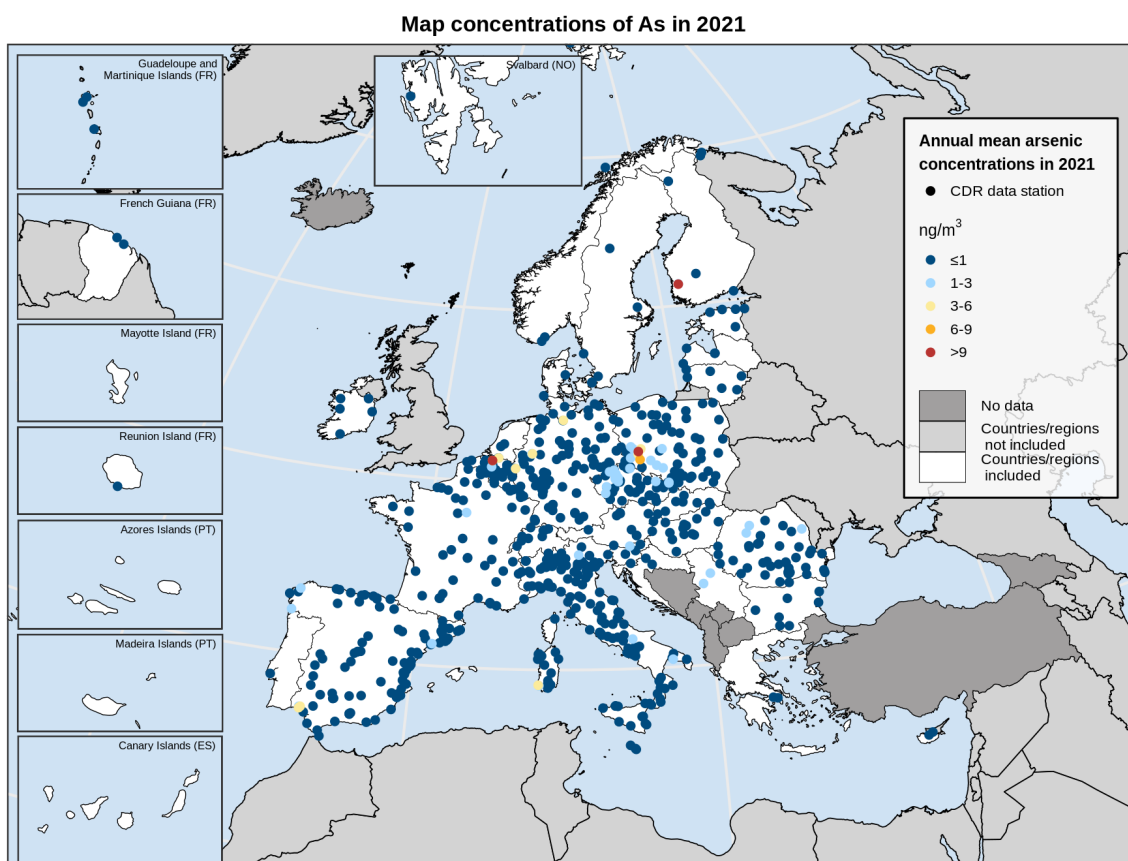


Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

## 7.4 Toxic metals

Data for **Arsenic (As)** were reported from 699 stations in the reporting countries shown in Figure 1. 5 stations measured concentrations above the target value ( $6 \text{ ng/m}^3$ ), located in: Belgium (two), Poland (two) and Finland (one), and 2 of these were industrial. Concentrations of As below the LAT ( $2.4 \text{ ng/m}^3$ ) were reported at 96 % of the stations (Figure 47).

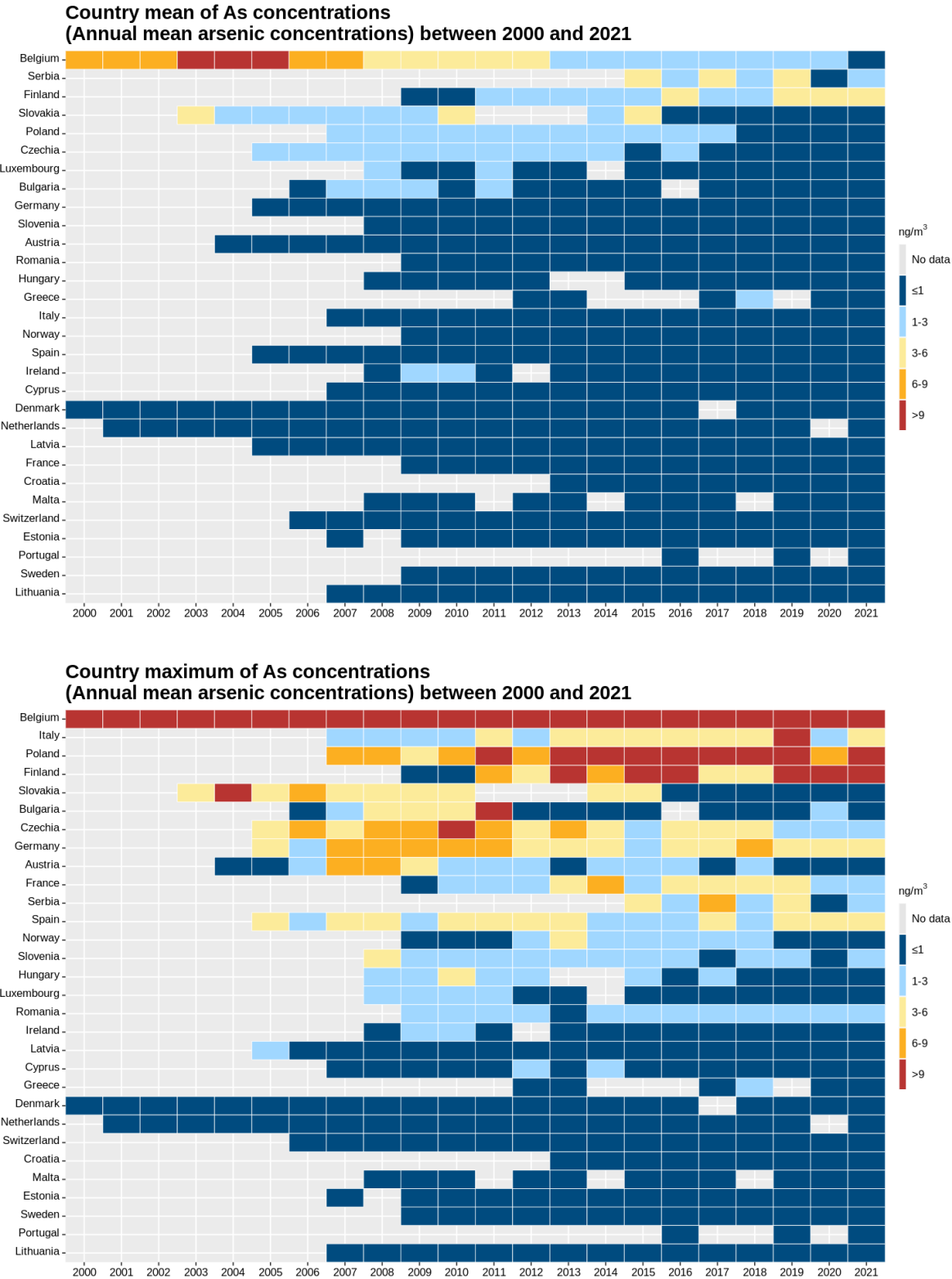
Figure 47: Map of As concentrations in 2021



Note: Observed concentrations of As in 2021. The last two colour categories correspond to concentrations above the EU target value. Only stations reporting more than 13 % of valid data have been included in the map.

Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) As annual mean concentrations at country level are shown in Figure 48. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, [2020](#)).

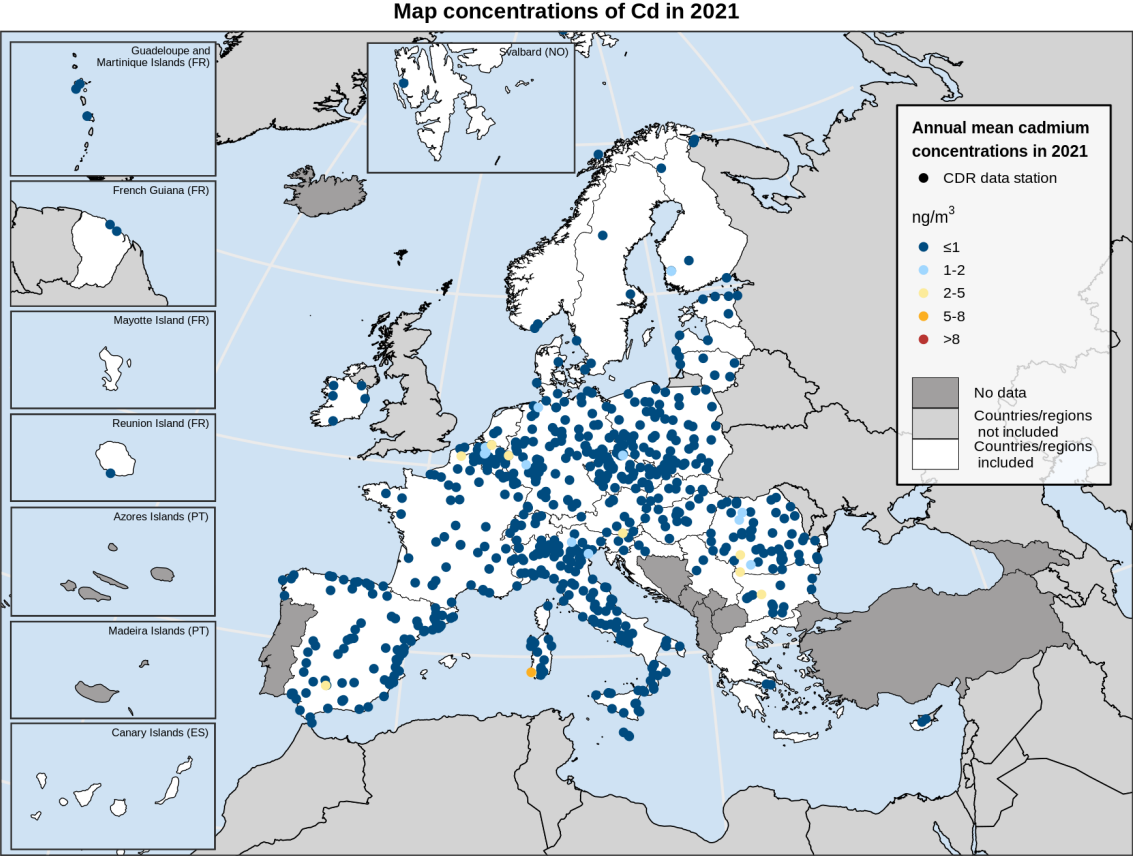
Figure 48: Evolution of mean (top) and maximum (bottom) As annual mean concentrations (target value) per country from 2000



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

**Cadmium (Cd)** data were reported from 717 stations in the reporting countries shown in Figure 1. Concentrations above the target value ( $5 \text{ ng/m}^3$ ) were measured at 1 station located in: Italy (one). At the great majority of stations (98 %), Cd concentrations were below the LAT ( $2 \text{ ng/m}^3$ ) (Figure 49).

Figure 49: Map of Cd concentrations in 2021

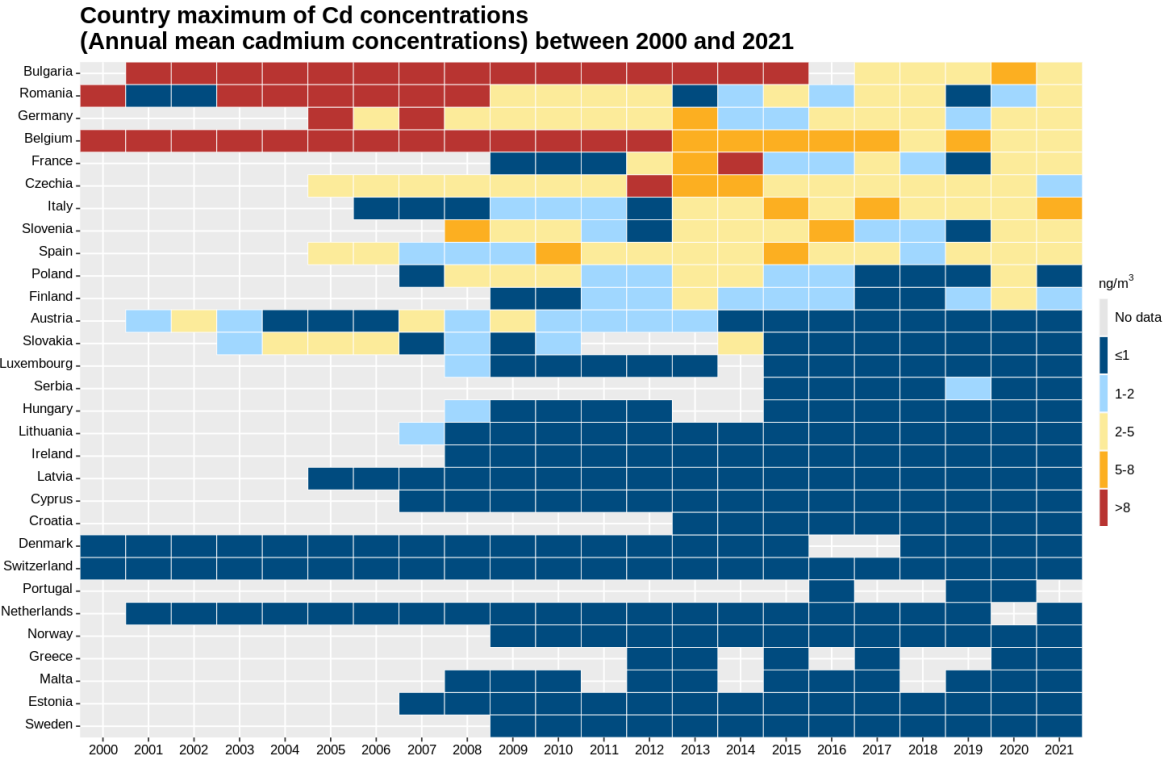
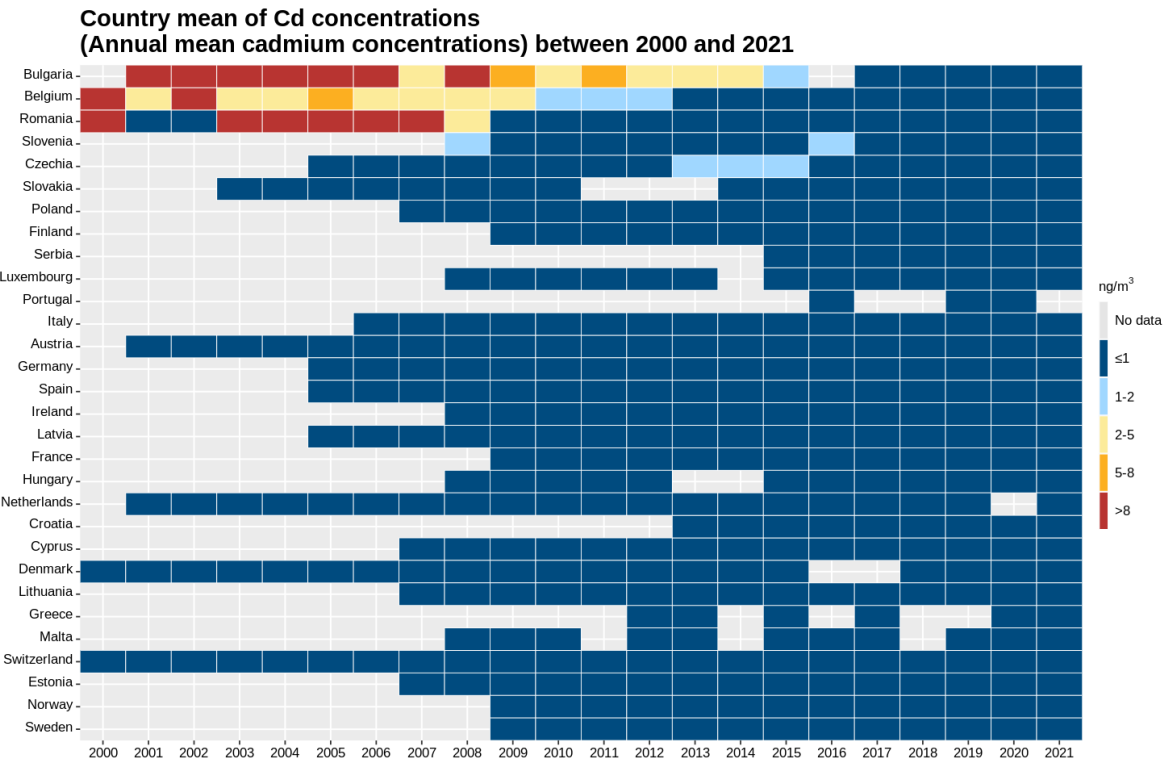


Note: Observed concentrations of Cd in 2021. The last two colour categories correspond to concentrations above the target value. Only stations reporting more than 13 % of valid data have been included in the map.

Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) Cd annual mean concentrations at country level are shown in Figure 50. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).



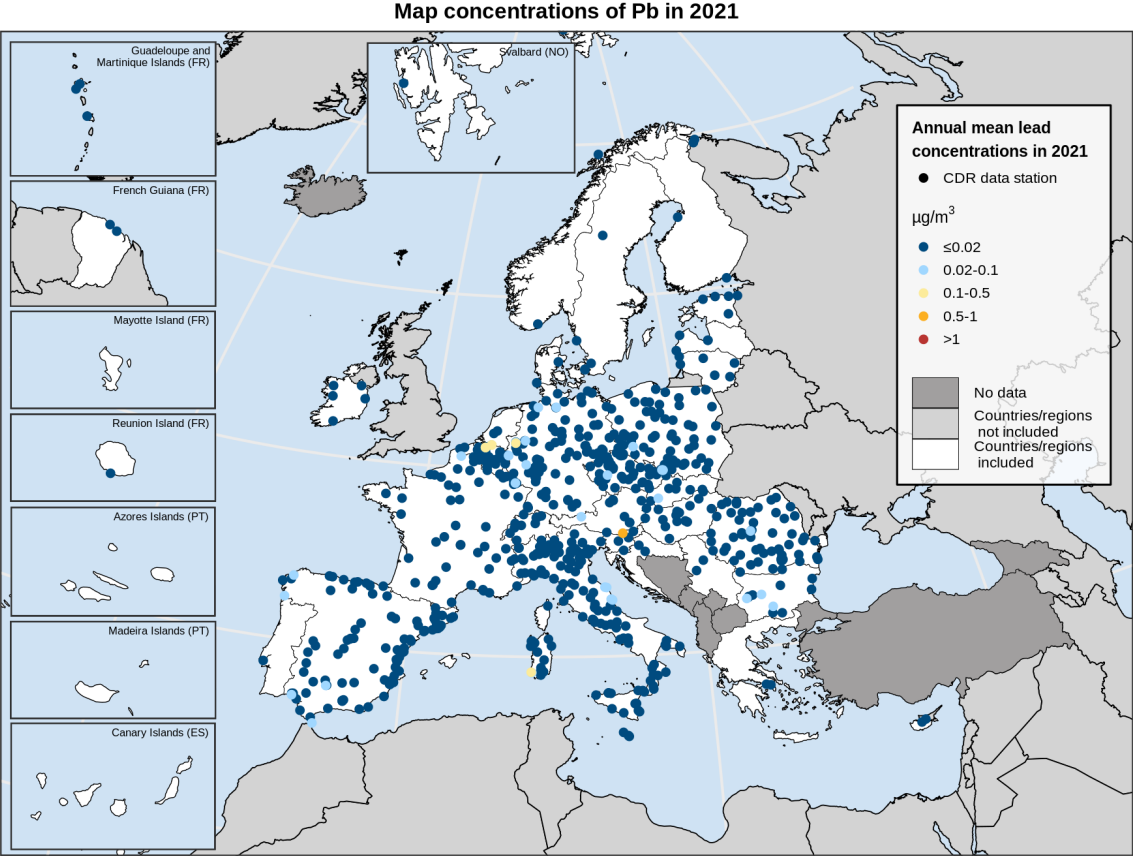
Figure 50: Evolution of mean (top) and maximum (bottom) Cd annual mean concentrations (target value) per country from 2000



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

Lead (Pb) data were reported from 711 stations in the reporting countries shown in Figure 1. 1 station located in: Slovenia (one) reported Pb concentrations above the  $0.5 \mu\text{g}/\text{m}^3$  limit value, 1 of which were industrial. 710 stations (100 % of the total) reported Pb concentrations below the LAT of  $0.25 \mu\text{g}/\text{m}^3$ .

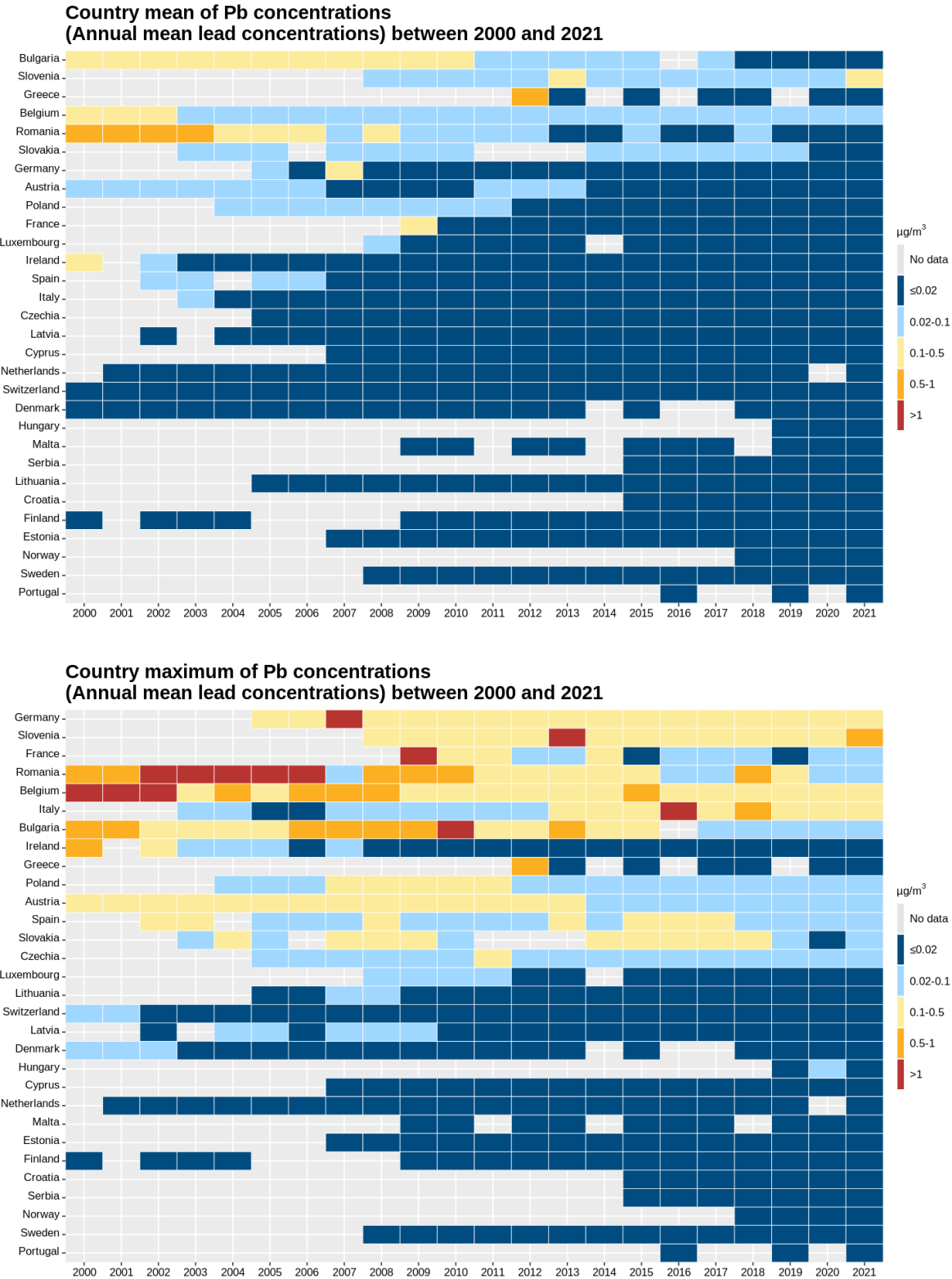
Figure 51: Map of Pb concentrations in 2021



Note: Observed concentrations of Pb in 2021. The last two colour categories correspond to concentrations above the EU annual limit value. Only stations reporting more than 13 % of valid data have been included in the map. Source: EEA, 2021.

Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) Pb annual mean concentrations at country level are shown in Figure 52. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

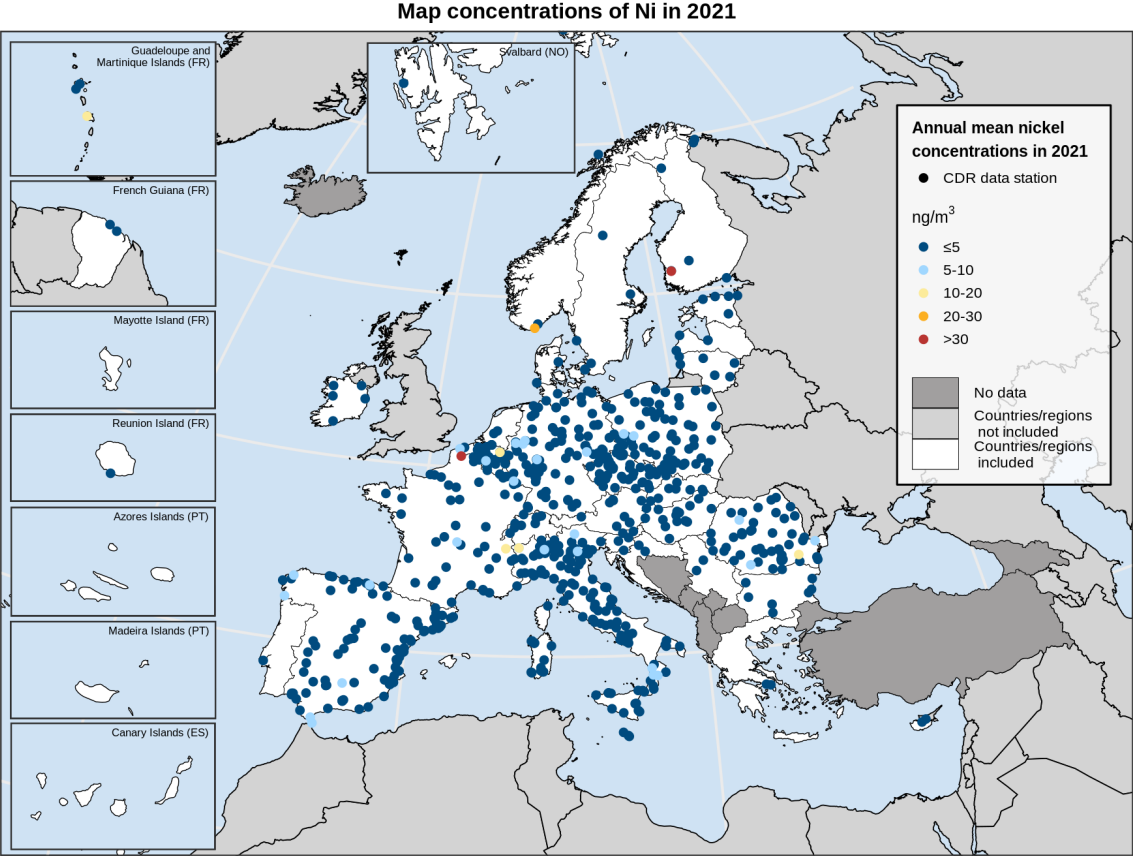
Figure 52: Evolution of mean (top) and maximum (bottom) Pb annual mean concentrations (limit value) per country from 2000



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

**Nickel (Ni)** data were reported from 696 stations in the reporting countries shown in Figure 1. Concentrations were above the target value of 20 ng/m<sup>3</sup> at 3 stations in: Finland (one), France (one) and Norway (one), 3 of which were industrial. About 99 % of the stations reported Ni concentrations below the LAT of 10 ng/m<sup>3</sup> (Figure 53).

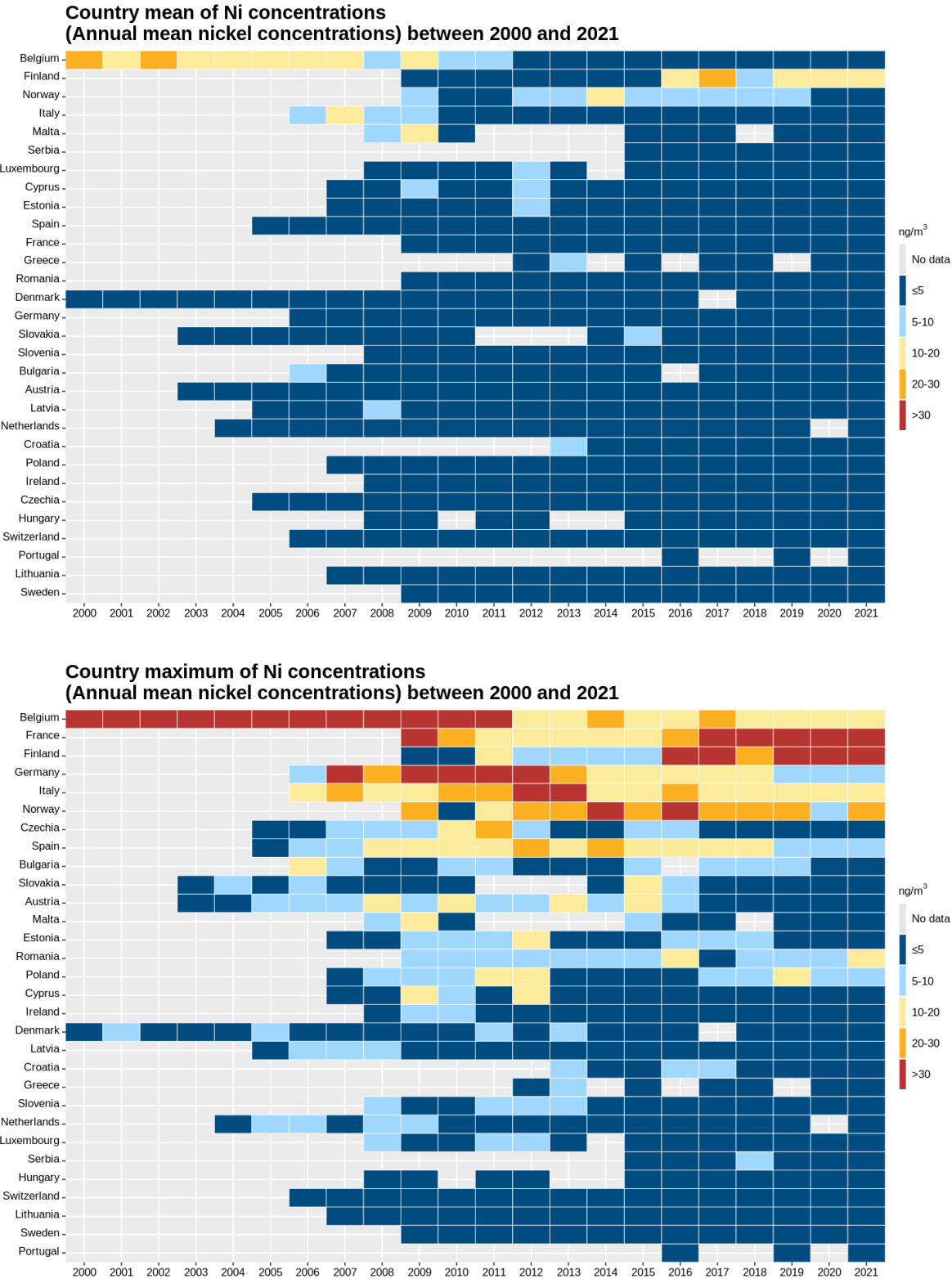
Figure 53: Map of Ni concentrations in 2021



Note: Observed concentrations of Ni in 2021. The last two colour categories correspond to concentrations above the target value. Only stations reporting more than 13 % of valid data have been included in the map.

Heatmaps with the evolution from 2000 of the mean (top) and the maximum (bottom) Ni annual mean concentrations at country level are shown in Figure 54. In this way, the evolution along years of the average and maximum measured concentration levels can be seen for each country. Note that meteorological variability has a considerable impact on year-to-year changes in ambient air concentrations of air pollutants (EEA, 2020).

Figure 54: Evolution of mean (top) and maximum (bottom) Ni annual mean concentrations (target value) per country from 2000



Note: It is important to note that the figure is not based on a consistent set of stations. The number, location and classification of the stations included may vary from year to year.

## 8 Abbreviations, units and symbols

$\mu\text{g}/\text{m}^3$ : microgram(s) per cubic metre

AAQD: Ambient Air Quality Directives

AEI: Average exposure indicator for PM<sub>2.5</sub> concentrations

AQG: Air quality guideline

As: Arsenic

BaP: Benzo[a]pyrene

C<sub>6</sub>H<sub>6</sub>: Benzene

Cd: Cadmium

CDR: Central data repository

CO: Carbon monoxide

ECO: Exposure concentration obligation

EEA: European Environment Agency

ETC HE: European Topic Centre on Human health and the Environment

EU: European Union

LAT: Lower assessment threshold

LV: limit value

$\text{mg}/\text{m}^3$ : milligram(s) per cubic metre

NERT: National exposure reduction target

$\text{ng}/\text{m}^3$ : nanogram(s) per cubic metre

Ni: Nickel

NO<sub>2</sub>: Nitrogen dioxide

O<sub>3</sub>: Ozone

Pb: Lead

PM: Particulate matter



PM<sub>2.5</sub>: Particulate matter with a diameter of 2.5 µm or less

PM<sub>10</sub>: Particulate matter with a diameter of 10 µm or less

RL: Reference level

SO<sub>2</sub>: Sulphur dioxide

TV: target value

WHO: World Health Organization

## 9 Annex

Data included in this report was received by 13 February 2023 from the reporting countries. By that date the number of stations by country aggregation reporting each pollutant is summarized in Table 3. Data from stations that do not fulfil the criteria from Box 1.1 are excluded from this report.

*Table 3: Reporting status of 2021 air quality data by 13 February 2023*

Countries	PM10	PM2.5	O3	NO2	BaP	SO2	CO	C6H6	As	Cd	Pb	Ni
EU27	2912	1702	2027	3320	778	1438	897	896	680	697	692	677
EEA32	3207	1863	2184	3560	794	1661	992	908	697	715	709	694
Total	3261	1904	2229	3611	794	1724	1044	908	699	717	711	696

Data not included in this report is summarized in Table 4:

*Table 4: Reporting outliers of 2021 air quality data by 13 February 2023*

Country	Station Eol Code	Pollutant	Aggregation(*)	Year	Value	Units	Data Coverage
Bosnia and Herzegovina	BA0046A	SO2	P1Y	2021	110	ug/m3	99
Italy	IT2250A	CO	P1Y-dx-max	2021	198	mg/m3	98
Türkiye	TRO047A	SO2	P1Y	2021	104	ug/m3	100
Türkiye	TRO047A	SO2	P1Y-day-max-per99.18	2021	700	ug/m3	100
Türkiye	TRO049A	PM10	P1Y-P1D-per99	2021	517	ug/m3	94
Türkiye	TRO049A	PM2.5	P1Y-P1D-per99	2021	404	ug/m3	93

(\*) <https://dd.eionet.europa.eu/vocabulary/aq/aggregationprocess/view>

The following table (Table 5) summarizes the average exposure indicator (AEI) by country.

*Table 5: AEI calculated at national level*

Country	Reference years	Initial AEI	Percentage of reduction	NERT
Austria	2009-2011	17.8	15.00	15.1
Belgium	2009-2011	19.0	20.00	15.2
Bulgaria	2008-2010	36.0	50.00	18.0
Croatia	2013-2015	20.6	20.00	16.5
Cyprus	2009-2011	21.5	20.00	17.2
Czechia	2009-2011	26.6	32.30	18.0
Denmark	2008-2010	14.0	15.00	11.9
Estonia	2009-2011	5.9	0.00	8.5
Finland	2009-2011	8.3	0.00	8.5
France	2009-2011	17.3	15.00	14.7
Germany	2008-2010	16.0	15.00	13.6
Greece	2008-2010	17.0	15.00	14.5
Hungary	2009-2010	21.0	20.00	16.8
Iceland	2008-2010	10.8	10.00	9.7
Ireland	2009-2011	10.2	10.00	9.2
Italy	2009-2011	19.9	20.00	15.9
Latvia	2008-2010	18.0	20.00	14.4
Lithuania	2009-2011	12.3	10.00	11.1
Luxembourg	2009-2010	17.4	15.00	14.8
Malta	2009-2011	13.2	15.00	11.2
Netherlands	2009-2011	17.0	15.00	14.5
Norway	2009-2011	10.0	10.00	9.0
Poland	2009-2011	27.8	35.25	18.0
Portugal	2008-2010	9.7	10.00	8.7
Romania	2009-2011	18.4	20.00	14.7
Slovakia	2009-2011	24.4	26.20	18.0
Slovenia	2009-2011	21.7	20.00	17.4
Spain	2009-2011	14.1	15.00	12.0
Sweden	2009-2011	6.6	0.00	8.5

Table 6 summarizes the number of sampling points per country with air quality levels above specific air quality objectives summarized through out this report.

Table 6: Number of sampling points above air quality levels/objectives per reporting country

Levels/Objectives	Andorra	Austria	Belgium	Bosnia and Herzegovina	Bulgaria	Croatia	Cyprus	Czechia	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Kosovo	Latvia	Lithuania	Luxembourg	Malta	Montenegro	Netherlands	North Macedonia	Norway	Poland	Portugal	Romania	Serbia	Slovakia	Slovenia	Spain	Sweden	Switzerland	Türkiye	
PM <sub>10</sub> daily LV (50 µg/m <sup>3</sup> )	0	0	0	15	11	3	1	4	0	0	0	7	0	7	4	0	0	126	4	1	0	0	1	3	0	12	0	94	0	7	7	3	0	11	2	0	168	
PM <sub>10</sub> daily WHO AQG level (45 µg/m <sup>3</sup> )	1	59	51	15	33	7	3	123	1	2	19	180	108	22	19	3	7	519	12	5	12	2	3	4	15	12	32	247	31	103	10	35	17	362	38	8	192	
PM <sub>10</sub> annual LV (40 µg/m <sup>3</sup> )	0	0	0	7	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	8	0	2	0	1	3	0	0	1	0	0	120	
PM <sub>10</sub> annual WHO AQG level (15 µg/m <sup>3</sup> )	1	63	51	15	33	7	3	122	4	1	3	190	145	23	19	0	4	508	10	5	14	4	3	4	43	12	21	249	27	111	9	38	16	328	24	6	199	
PM <sub>2.5</sub> annual LV (25 µg/m <sup>3</sup> )	0	0	0	10	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	4	0	7	0	0	0	0	0	0	0	0	17	
PM <sub>2.5</sub> annual WHO AQG level (5 µg/m <sup>3</sup> )	1	60	67	11	5	10	4	86	8	1	8	180	265	11	12	1	34	303	12	4	8	4	4	4	47	8	42	130	12	26	2	37	5	260	22	6	98	
PM <sub>2.5</sub> daily WHO AQG level (15 µg/m <sup>3</sup> )	1	60	70	11	6	10	4	86	8	6	18	182	272	11	12	4	34	306	12	4	8	4	4	4	47	11	43	130	16	26	2	37	5	272	30	7	94	
O <sub>3</sub> max daily 8h mean TV (120 µg/m <sup>3</sup> )	0	4	0	2	2	2	2	1	0	0	0	6	3	12	3	0	0	154	2	0	0	0	1	0	0	1	0	1	3	2	5	0	3	16	0	3	29	
O <sub>3</sub> long-term objective (120 µg/m <sup>3</sup> )	1	104	36	6	11	10	3	63	8	7	11	244	265	17	14	0	2	307	6	2	2	5	4	0	45	6	2	87	27	31	8	11	9	278	15	29	70	
O <sub>3</sub> short-term WHO AQG level (100 µg/m <sup>3</sup> )	1	105	40	8	12	11	3	64	7	9	12	284	270	18	14	0	11	325	7	3	10	5	4	0	45	10	4	98	32	57	8	17	9	361	18	29	77	
O <sub>3</sub> peak season WHO AQG level (60 µg/m <sup>3</sup> )	2	103	40	4	16	10	3	64	8	9	17	281	268	16	16	0	15	337	7	6	11	5	4	0	45	2	11	93	33	28	8	17	2	405	23	29	84	
NO <sub>2</sub> annual LV (40 µg/m <sup>3</sup> )	0	0	0	0	1	1	0	0	0	0	0	11	4	3	0	0	0	20	0	0	0	0	0	0	0	0	0	4	0	3	1	0	0	1	0	0	44	
NO <sub>2</sub> annual WHO AQG level (10 µg/m <sup>3</sup> )	1	112	102	14	20	9	2	71	5	1	14	259	541	17	21	2	13	476	9	7	10	75	3	3	63	4	38	109	25	134	13	18	8	290	42	25	141	
NO <sub>2</sub> hourly LV (200 µg/m <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
NO <sub>2</sub> daily WHO AQG level (25 µg/m <sup>3</sup> )	1	116	106	13	17	10	2	76	6	5	30	286	554	17	21	3	14	495	8	7	13	23	3	3	70	5	40	119	25	122	13	22	9	322	44	26	137	
BaP annual LV (1 ng/m <sup>3</sup> )	0	2	0	0	3	2	0	18	0	1	2	0	0	0	8	0	0	13	0	1	0	0	0	0	0	0	1	152	0	0	0	11	0	1	0	0	0	
BaP annual WHO AQG level (0.12 ng/m <sup>3</sup> )	0	28	13	0	14	2	0	51	0	4	8	29	78	1	18	0	3	136	0	5	5	2	0	0	1	0	5	164	0	4	0	18	4	41	0	6	0	
SO <sub>2</sub> hourly LV (350 µg/m <sup>3</sup> )	0	0	0	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	0	0	0	0	0	3	
SO <sub>2</sub> daily LV (125 µg/m <sup>3</sup> )	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	0	0	0	0	0	3	
SO <sub>2</sub> daily WHO AQG level (40 µg/m <sup>3</sup> )	0	0	1	19	3	0	0	3	0	0	0	6	1	0	0	4	1	1	0	0	0	0	0	1	1	1	3	4	0	2	8	0	0	4	1	0	46	
CO daily LV (10 mg/m <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	
CO daily WHO AQG level (4 mg/m <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
C <sub>6</sub> H <sub>6</sub> annual LV (5 µg/m <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
C <sub>6</sub> H <sub>6</sub> annual WHO RL (1.7 µg/m <sup>3</sup> )	0	0	0	0	0	1	0	10	0	0	0	6	3	5	2	0	0	8	0	4	0	0	0	0	0	0	0	6	0	78	0	0	0	1	0	0	0	

Table 6: Number of sampling points above air quality levels/objectives per reporting country (continued)

Levels/Objectives	Andorra	Austria	Belgium	Bosnia and Herzegovina	Bulgaria	Croatia	Cyprus	Czechia	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Kosovo	Latvia	Lithuania	Luxembourg	Malta	Montenegro	Netherlands	North Macedonia	Norway	Poland	Portugal	Romania	Serbia	Slovakia	Slovenia	Spain	Sweden	Switzerland	Türkiye	
As annual TV (6 ng/m <sup>3</sup> )	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	
As annual LAT (2.4 ng/m <sup>3</sup> )	0	0	5	0	0	0	0	3	0	0	2	1	3	0	0	0	0	2	0	0	0	0	0	0	0	0	0	5	0	2	0	0	0	0	3	0	0	0
Cd annual TV (5 ng/m <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd annual LAT (2 ng/m <sup>3</sup> )	0	0	3	0	1	0	0	0	0	0	0	1	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	1	0	0	0	0
Pb annual LV (0.5 µg/m <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Pb annual LAT (0.25 µg/m <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ni annual TV (20 ng/m <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Ni annual LAT (10 ng/m <sup>3</sup> )	0	0	1	0	0	0	0	0	0	0	1	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0

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