VIII. EUROPEAN CONTEXT

Air pollution in large industrial areas has been one of the serious environmental problems in Europe since roughly the middle of the last century. The well-known episodes of the "London smog" forced not only the UK, but also other Western European countries to gradually adopt national laws to reduce air pollution.

In the 1960s, it became apparent that the problem could only be solved through international cooperation. Studies within a program for investigation of long-range transmission of air pollution carried out under the auspices of the Organisation for Economic Cooperation and Development (OECD) in 1971–1977 have shown that acidification of rivers and lakes in Scandinavia is a result of so-called acid rain caused by pollutants released into the atmosphere in continental Europe. Consequently, the first internationally binding document was adopted to resolve problems connected with air pollution at a broad regional level, namely the Convention on Long-Range Transboundary Air Pollution (CLRTAP) which was adopted by the UN Economic Commission for Europe in 1979.

Measures introduced both under CLRTAP and later under European Union (EU) legislation, in particular, resulted in significant improvement of air quality in Europe in recent decades. Emissions of many pollutants have suitably been reduced, but pollution from suspended particulate matter and ozone still poses serious risks. A considerable part of the European population and ecosystems continues to be exposed to higher concentrations of pollutants than the legislatively stipulated limit levels and values recommended by the World Health Organisation (WHO).

Despite these improvements, air pollution is one of the highest--risk environmental factors causing premature death, increasing the incidence of a wide range of diseases, damaging vegetation and ecosystems and leading to a loss of biodiversity in Europe. All these factors also lead to significant economic losses. A further improvement will require measures and cooperation on a global, continental, national and local level in most branches of the economy with public participation. The measures must include technological development, structural changes including optimisation of the infrastructure and territorial planning, as well as a change in behaviour. The protection of natural capital, the promotion of economic prosperity, human well-being and social development are part of the European Union 2050 vision, set out in the 7th EU Environmental Action Programme (EU 2013).

Emissions of pollutants and greenhouse gases within Europe

Emissions of the main pollutants released into the ambient air in Europe have decreased since 1990. Nonetheless, this reduction has not been sufficient in all the sectors and the emissions of some pollutants have even increased. For example, there has not been a sufficient reduction in NO_x emissions from mobile sources and therefore air pollution limits are not complied with in many cities. In the past decade, $PM_{2.5}$ and benzo[*a*]pyrene emissions have also increased in the EU as a result of incomplete combustion of coal and biomass in households and in private and public buildings. These sources now make the greatest contribution to emissions of particulates and benzo[*a*]pyrene in the EU (Fig. VIII.1).

Greenhouse gas emissions are declining, particularly CO_2, CH_4 and N_2O emissions (Fig. VIII.2). On the contrary, there is an increase in fluorocarbon emissions in recent years. This is due to the longer retention of these substances in the equipment in which they are used. Overall, however, there are international obligations to reduce greenhouse gas emissions based on the requirements of both the UN Framework Convention on Climate Change and the related regulations of the European Union. Reducing emissions of fluorinated gases and limiting their use is also required by the Montreal Protocol.

Air quality monitoring in Europe

Long-term monitoring of air quality is at a high level in Europe which is, together with North America, a continent with the highest density of measuring stations. The national air quality monitoring networks are operated by the individual countries in accordance with the EU legislation, but practical provisions for these networks differ in the countries. In some, they are managed centrally by environmental agencies or meteorological institutes, in others by regional authorities. The central European database of pollutant concentrations measured at air quality monitoring stations (AQ e-reporting database) is operated by the European Environment Agency (EEA). Each year, individual countries transmit data measured within their monitoring networks to the EEA on the basis of EU legislation.

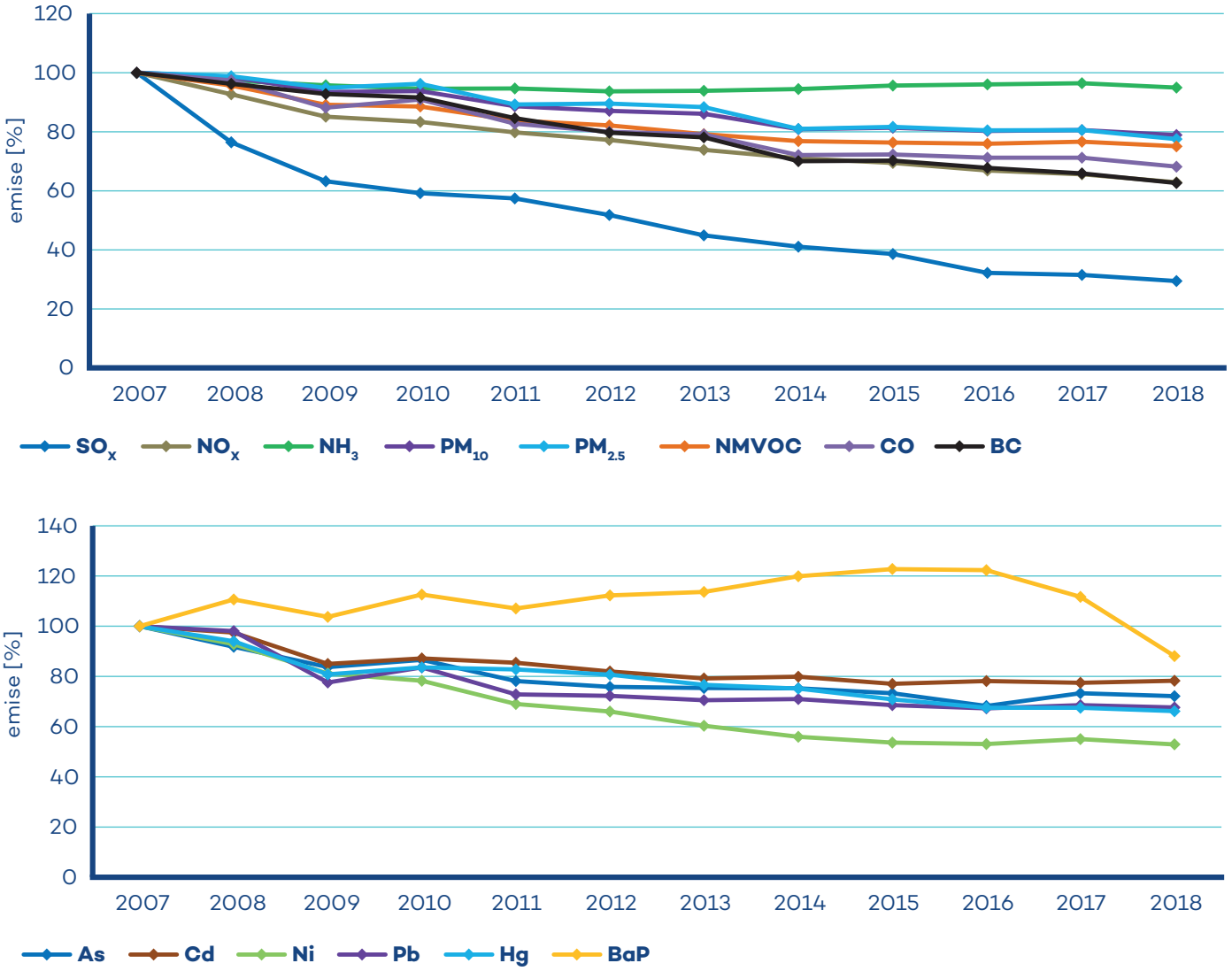
In addition to the national networks, long-term pan-European projects are being implemented, whose main goals include detecting long-term trends in air quality in a European-wide context. These programmes are implemented under CLRTAP (EMEP and the group for evaluating the impacts of long-range transboundary air pollution), within the World Meteorological Organization (WMO) GAW programme, and in the framework of European

research infrastructures (ACTRIS, ICOS). Long-range transport of pollutants across the continent and beyond is addressed by the CLRTAP convention under the EMEP program. The program was established in 1977 and one of its main goals is to monitor long-term trends in air quality on a regional scale, based on measurements at selected background locations.

Current state of air quality in Europe

From the viewpoint of damage to human health in Europe, the greatest problems are caused by concentration levels of particulate matter (PM), ground-level ozone (O_3), nitrous oxide (NO_2) and carcinogenic benzo[*a*]pyrene. Polluted air causes serious health problems especially for inhabitants of cities and municipalities. Damage to ecosystems is most extensively induced by O_3, and, in addition, increased concentrations of nitrogen oxides (NO_X) contribute to nitrogen deposition causing eutrophication.

It has been estimated that, in the three-year 2016–2018 period, 13–17% of the urban population in the EU Member States were exposed to above-limit 24-hour PM_{10} concentrations, 4–8% to above-limit annual $PM_{2.5}$ concentrations, 15–22% to annual benzo[*a*]pyrene concentrations over the target value, 12–34% to O_3 concentrations greater than the target value and 4–7% to above-limit annual NO_2 concentrations (EEA 2020).



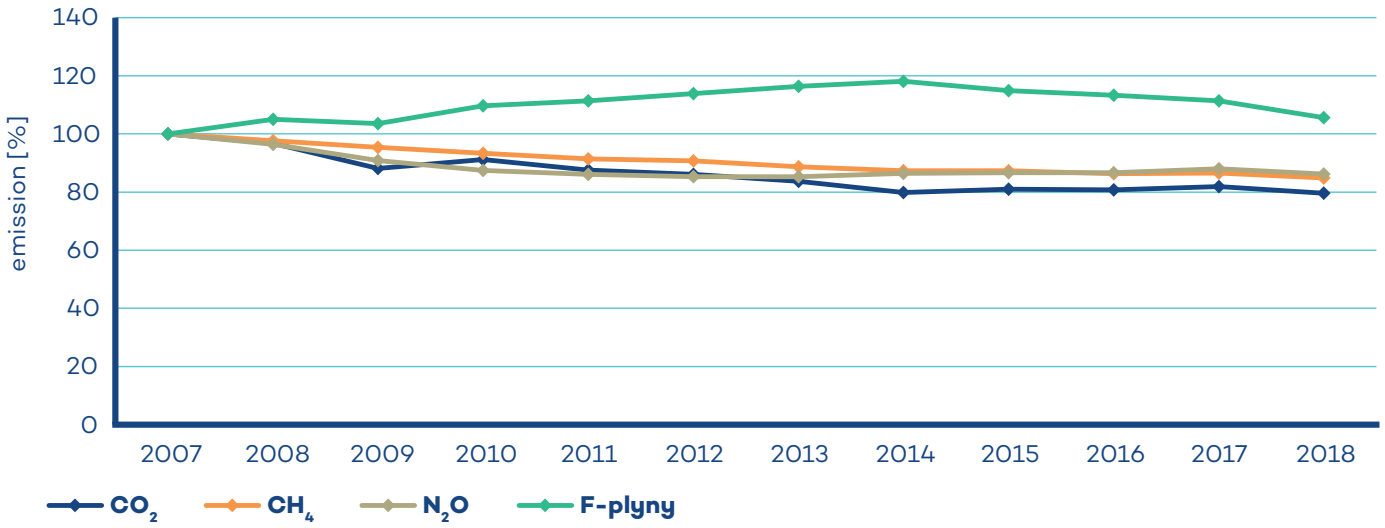
Pozn.: Emise jsou vyjádřeny podílem vůči emisím roku 2007. Údaje o využívání půdy, změny ve využívání půdy a lesnictví jsou k dispozici do roku 2012. Předávání zpráv o emisích BC je dobrovolné, nejsou tedy zahrnuty všechny státy.

Data viz National emissions reported to the Cenvention on Long-range Transboundary Air Pollution (LRTAP Convention)
https://www.eea.europa.eu/data-and-maps/dashboards/air-pollutant-emissions-data-viewer-3

Zdroj dat: EEA

Fig. VIII.1 Air pollutant emissions of 28 Member States of the European Union, 2007–2018

The estimate of the percentage of urban population exposed to concentrations higher than the values recommended by WHO was even greater, namely 43–48% concerning annual concentration of PM_{10}, 74–78% concerning annual concentration of $PM_{2.5}$, 75–90% concerning annual concentration of benzo[*a*]pyrene, 96–99% concerning O_3, 4–7% concerning annual concentration of NO_2, and 19–29% concerning 24-hour concentration of SO_2 (EEA 2020).



Pozn.: Emise jsou vyjádřeny podílem vůči emisím roku 2007. Emise jsou uvedeny včetně emisí ze sektoru využívání území, změny ve využívání území a lesnictví.

Data viz National inventory of greenhouse gas emissions 2020 (UNFCCC)
https://unfccc.int/ghg-inventories-annex-i-parties/2020

Zdroj dat: UNFCCC

Fig. VIII.2 Greenhouse gas emissions of 28 Member States of the European Union, 2007–2018

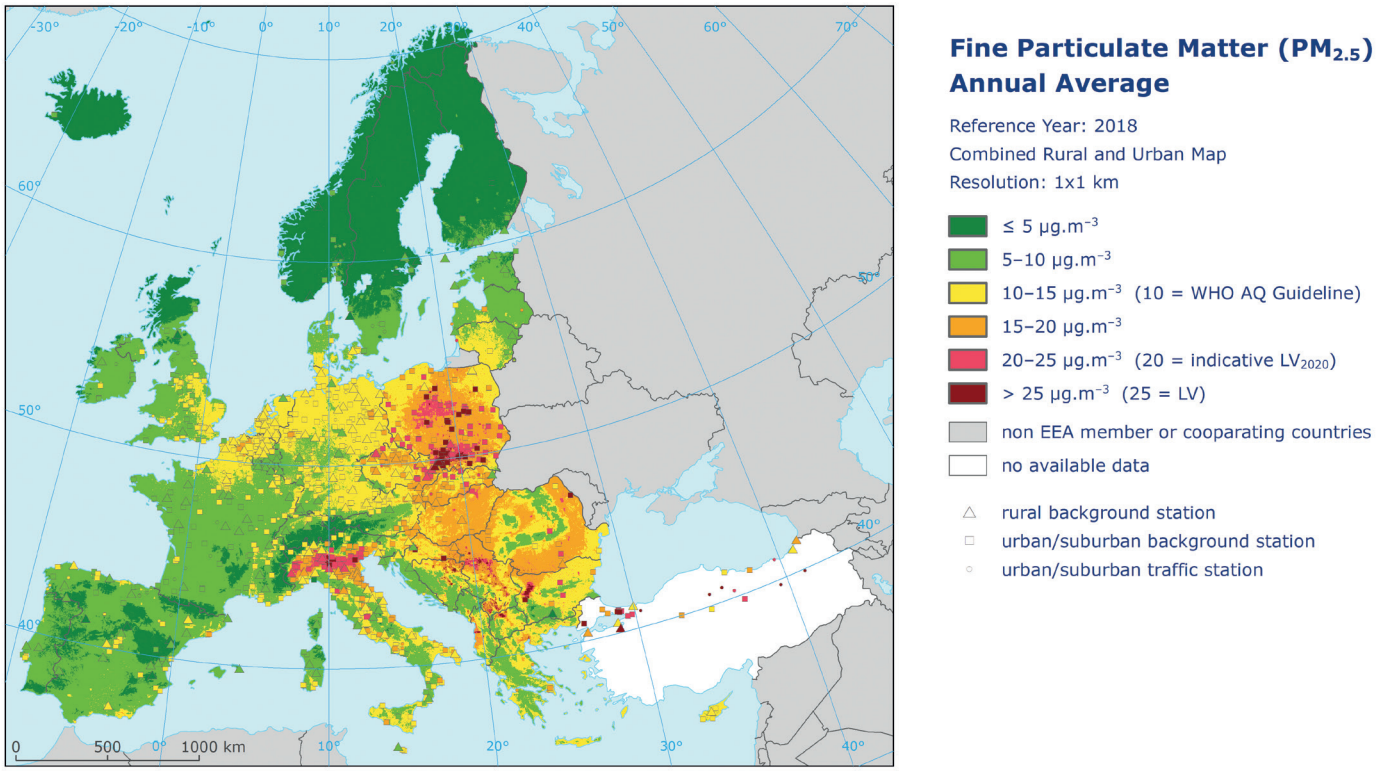


Fig. VIII.3 Field of annual average concentration of $PM_{2.5}$ in Europe, 2018

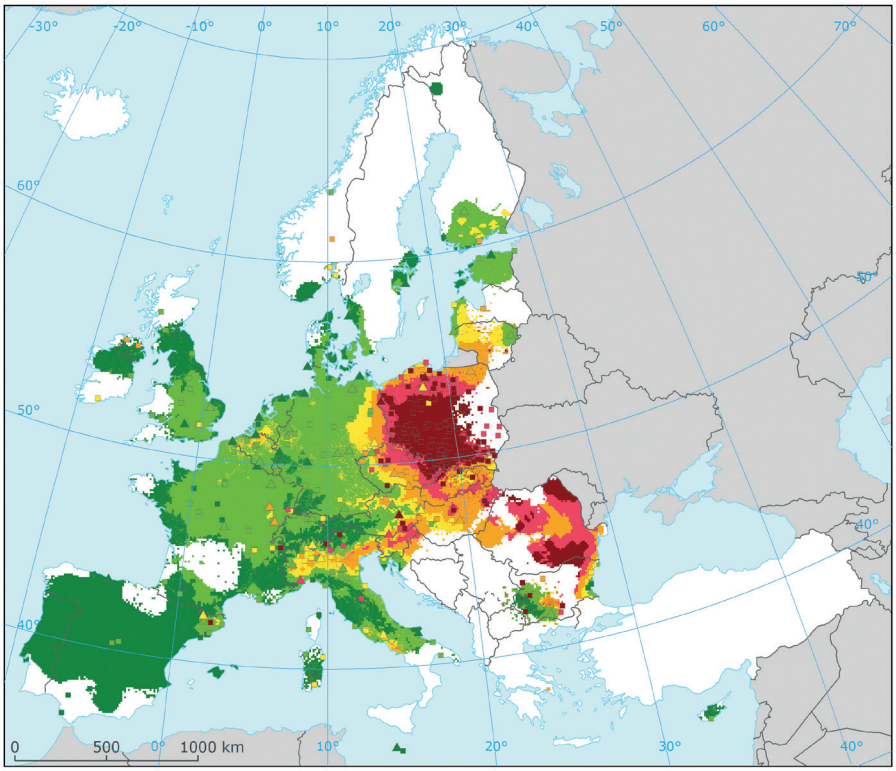


Fig. VIII.4 Field of annual average concentration of benzo[*a*]pyrene in Europe, 2018

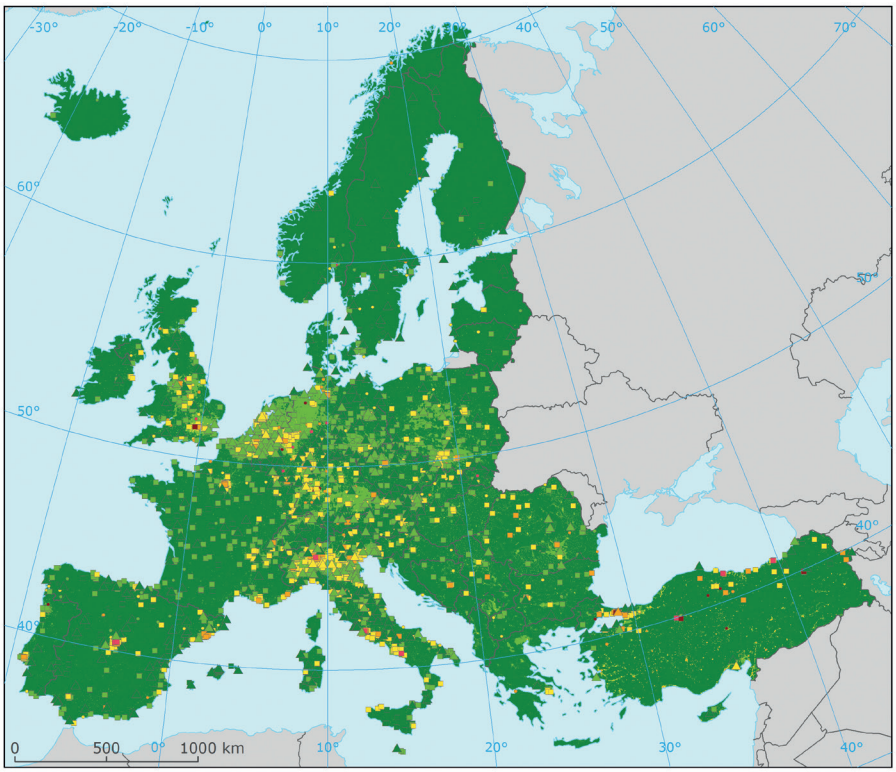


Fig. VIII.5 Field of annual average concentration of NO_2 in Europe, 2018

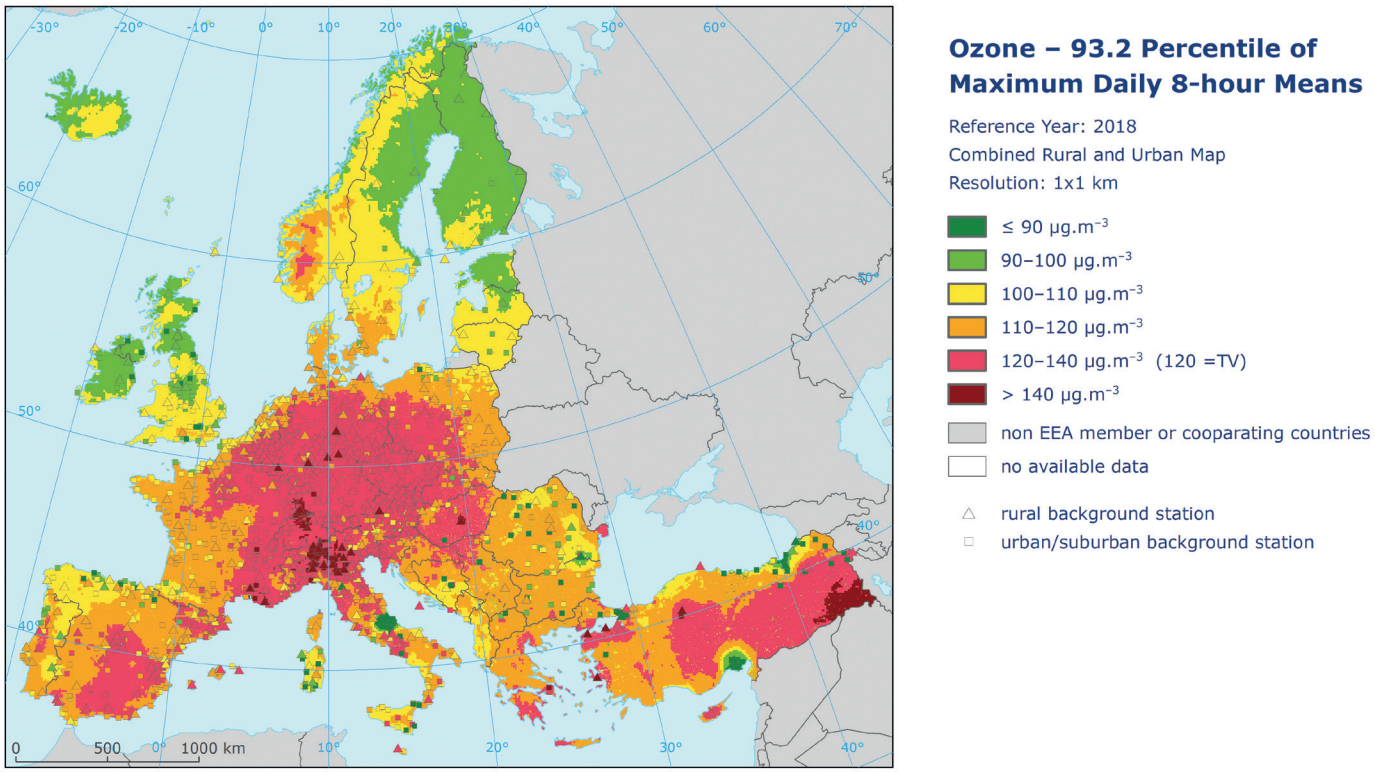


Fig. VIII.6 Field of 93.2 percentile of daily maximum 8-hour O_3 concentrations in Europe, 2018

Estimates of health impacts of the effect of polluted air indicate that long-term exposure to fine particulates $PM_{2.5}$ in Europe in 2018 contributed to approx. 417 thousand premature deaths, long-term exposure to high NO_2 concentrations to 55 thousand and short-term exposure to concentrations of O_3 to approx. 21 thousand premature deaths (EEA 2020).

The inhabitants of Central and Eastern Europe, including the Balkan Peninsula, suffer from the greatest exposure to above-limit concentrations of suspended particulates and benzo[*a*]pyrene, while the areas with the most widespread pollution also include the Po Valley in northern Italy (Fig. VIII.3, Fig. VIII.4).

Limit NO_2 concentrations are exceeded especially in areas affected by transportation (Fig. VIII.5). The occurrence of above-limit concentrations can also be anticipated in countries where these pollutants are monitored only at a limited number of sites or are not monitored at all or this data is not provided to EEA.

The primary pollutants that are derived from local and other emission sources are also accompanied by air pollution by secondary aerosol (Chap. IV.2.3, Chap. IV.9.3) and ground level ozone. In relation to the mechanism of its formation (Chap. IV.4.3), the ground level ozone concentrations increase from low values in northern Europe to the highest values especially in countries around the Mediterranean Sea (Fig. VIII.6).

Air quality of the Czech Republic in the European context

The pollution levels in various parts of the Czech Republic differ substantially. On the one hand, there are areas with very low pollution levels, in which the air quality is similar to that in the continuously unpopulated regions of Europe and the pollutant concentrations are well below the pollution limit levels. The data from the Czech EMEP background stations are comparable with the concentrations measured at similarly located Central European stations. On the other hand, the O/K/F-M agglomeration, together with the adjacent areas in the Republic of Poland, is among the most highly polluted regions of Europe, both from the standpoint of the extent and from the level of concentrations (Chap. IV.3). Transmission of pollutants across the border between the Czech Republic and neighbouring countries is the most intense in the Silesia area (for more details, see Chap. V.3 and Blažek et al. 2013). Obviously, polluted air flows across the state borders in other areas, but the mutual transboundary effect is much lower and its quantification or even an estimate of probable impact is mostly not available. In addition to the Silesia area, the share of various sources to the air pollution level has only been described in the Czech-Slovak boundary area of the Moravian-Silesia and Žilina regions (VŠB-TU Ostrava 2014).

Regarding the level of average concentrations per capita, in terms of suspended particulate matter $PM_{2.5}$, PM_{10} and benzo[*a*]pyrene, the Czech Republic belongs to the above-average polluted countries, in terms of ozone, to the average to above-average polluted countries, and in terms of NO_2, to the average polluted countries (EEA 2019).