IV.7 Sulphur dioxide

IV.7.1 Air pollution by sulphur dioxide in 2021

Air pollution by sulphur dioxide in relation to the pollution limit value for the protection of human health

In 2021, neither the hourly nor 24-hour pollution limits for sulphur dioxide (SO_2) were exceeded at any monitoring station in the CR, so both pollution limits were met. Nor were any concentrations of this substance exceeding the limit values in the permitted number of cases observed.

The highest hourly SO_2 concentrations were measured at the stations of Lom (251 µg·m^{-3}), Český Těšín (240 µg·m^{-3}), and Chotěbuz (209 µg·m^{-3}).

The highest 24-hour SO_2 concentrations were measured at the Ostrava-Radvanice ZÚ (98 µg·m^{-3}), Český Těšín (73 µg·m^{-3}), and Lom (63 µg·m^{-3}) stations.

The 25th highest hourly SO_2 concentration value reached the highest levels at the Ostrava-Radvanice ZÚ (121 µg·m^{-3}), Český Těšín (103 µg·m^{-3}), Lom (91 µg·m^{-3}), Ostrava-Radvanice OZO (90 µg·m^{-3}), Chotěbuz (67 µg·m^{-3}), Krupka (57 µg·m^{-3}), and Karviná (56 µg·m^{-3}) stations.

The fourth highest 24-hour SO_2 concentrations reached their highest values at nearly the same stations, namely Ostrava-Radvanice ZÚ (54 µg·m^{-3}), Lom (43 µg·m^{-3}), Český Těšín (42 µg·m^{-3}), Chotěbuz (36 µg·m^{-3}), Ostrava-Radvanice OZO (34 µg·m^{-3}), and Teplice (30 µg·m^{-3}).

The influence of industrial sources can predominantly be expected at the Lom station, while the influence of local heating from the surrounding municipalities cannot be ruled out with a certain wind direction. At the Ostrava-Radvanice ZÚ and Ostrava-Radvanice OZO stations, increased concentrations of SO_2 occur mainly in connection with local sources in the vicinity of the stations. In the case of the Český Těšín station, but also other border station – Věřňovice, SO_2 emissions from local sources at the Czech-Polish border area are involved.

On 99.98 % of the area of the CR, the fourth highest 24-hour concentrations of SO_2 were under the lower assessment threshold (50 µg·m^{-3}). In only 0.02% of the territory the lower assessment threshold was exceeded, involving just the cities of Ostrava and Třinec (Fig. IV.7.1).

The point symbols at the stations designate the fourth highest 24-hour SO_2 concentrations measured at the air quality monitoring stations (Fig. IV.7.2).

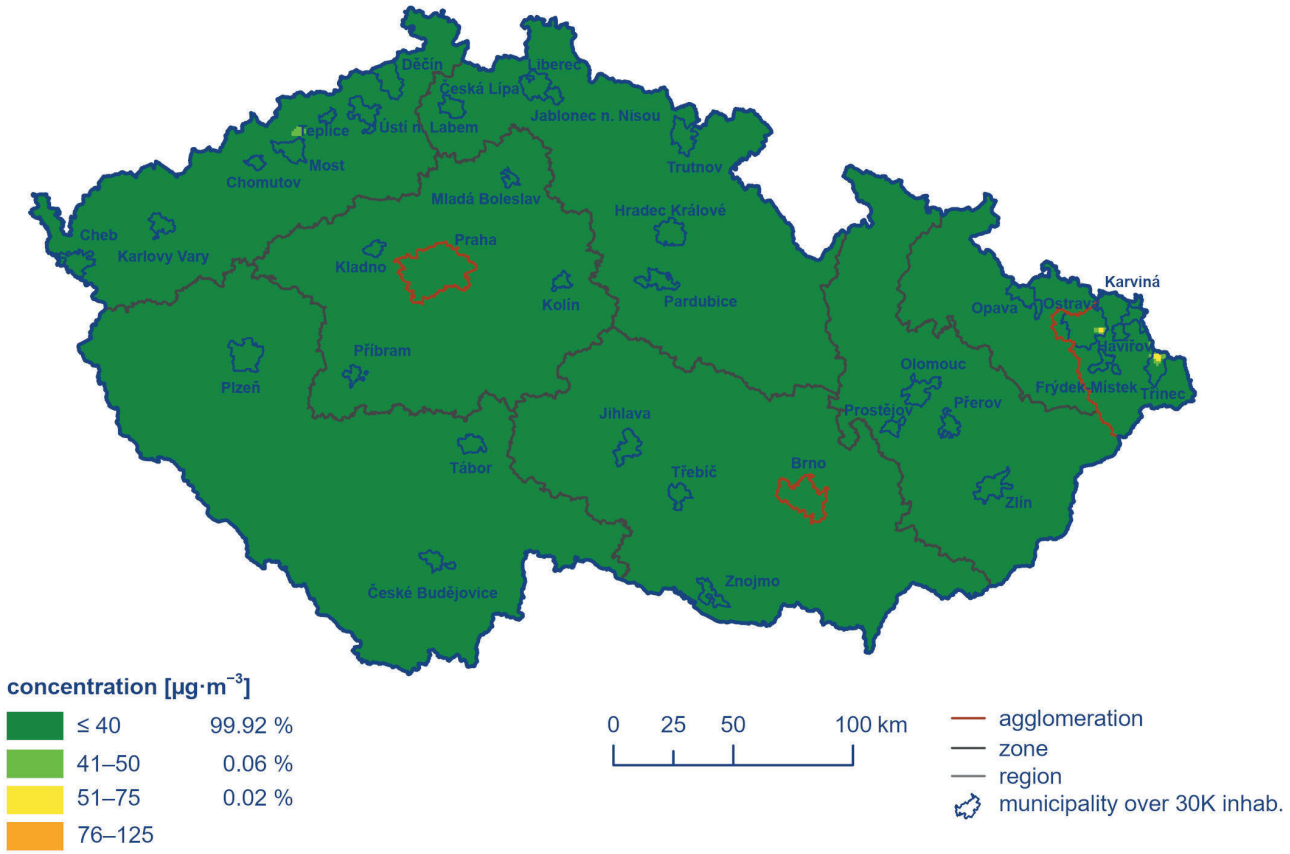

Fig. IV.7.1 Field of 4th highest 24-hour SO_2 concentration, 2021

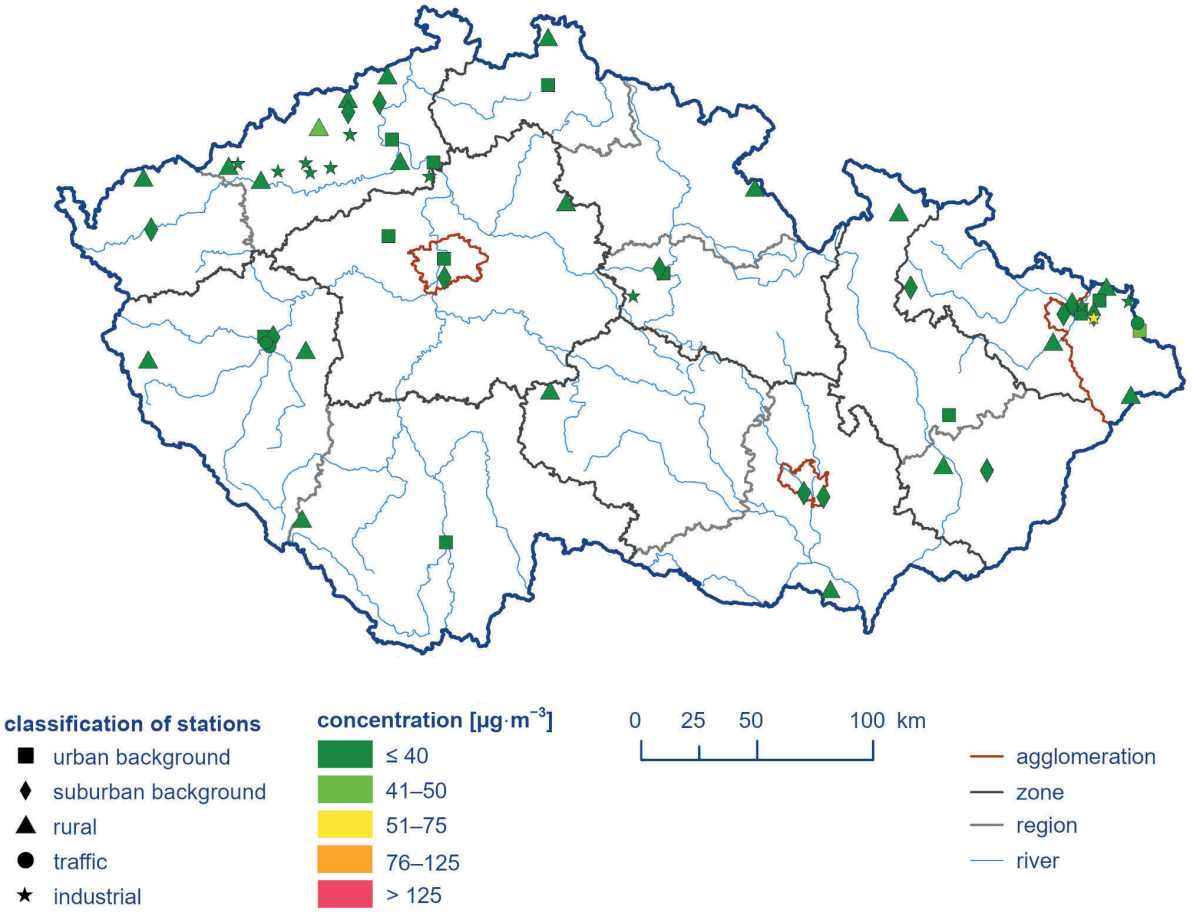

Fig. IV.7.2 4th highest 24-hour SO_2 concentrations at air quality monitoring stations, 2021

Air pollution by sulphur dioxide in 2021 in relation to the pollution limit value for the protection of ecosystems and vegetation

In 2021, neither the annual nor winter average concentrations exceeded the pollution limit value at rural locations. The highest winter average concentrations 2021/2022 were recorded at the Krupka (7.5 µg·m^{-3}), Věřňovice (7.2 µg·m^{-3}), Lom (6.5 µg·m^{-3}), Studénka (6.1 µg·m^{-3}), Sněžník (4.2 µg·m^{-3}), Těšnovice (3.8 µg·m^{-3}), and Rožďalovice-Ruská (3.8 µg·m^{-3}) stations. The annual average concentrations attained maximum values at the same stations in a different order – Lom (7 µg·m^{-3}), Krupka (6.8 µg·m^{-3}), Věřňovice (5.8 µg·m^{-3}), Studénka (4.7 µg·m^{-3}), Sněžník (4.1 µg·m^{-3}), Rožďalovice-Ruská (3.9 µg·m^{-3}), and Těšnovice (3.6 µg·m^{-3}).

In rural areas of the CR, the upper assessment threshold (12 µg·m^{-3}) was exceeded in 2021 neither for the annual average SO_2 concentration nor the average concentration of the winter period 2021/2022. The upper assessment threshold for the annual and winter average SO_2 concentration was exceeded only in the cities of Ostrava and Třinec, where the pollution limit of 20 µg·m^{-3} was also exceeded for both mentioned pollution characteristics (Fig. IV.7.3 and IV.7.4). This exceeded value is based on model calculations when constructing the map.

All the background stations measuring SO_2 were used to construct the two maps, taking into account their classification (Fig. IV.7.3 and Fig. IV.7.4). Point symbols on the maps designate only rural stations because the average winter and annual average SO_2 concentrations are only measured at these locations in relation to pollution limit values for the protection of ecosystems and vegetation.

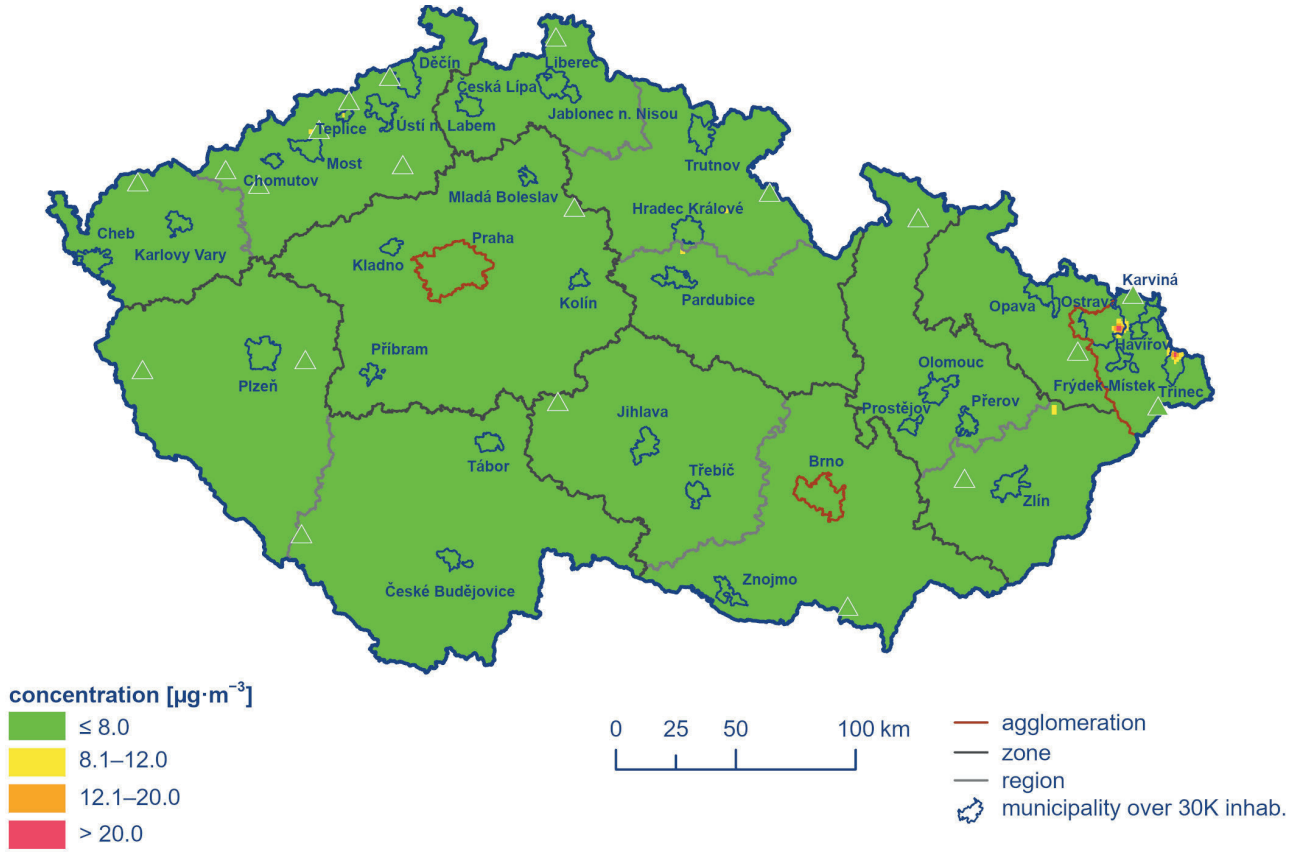

Fig. IV.7.3 Field of annual average SO_2 concentration, 2021

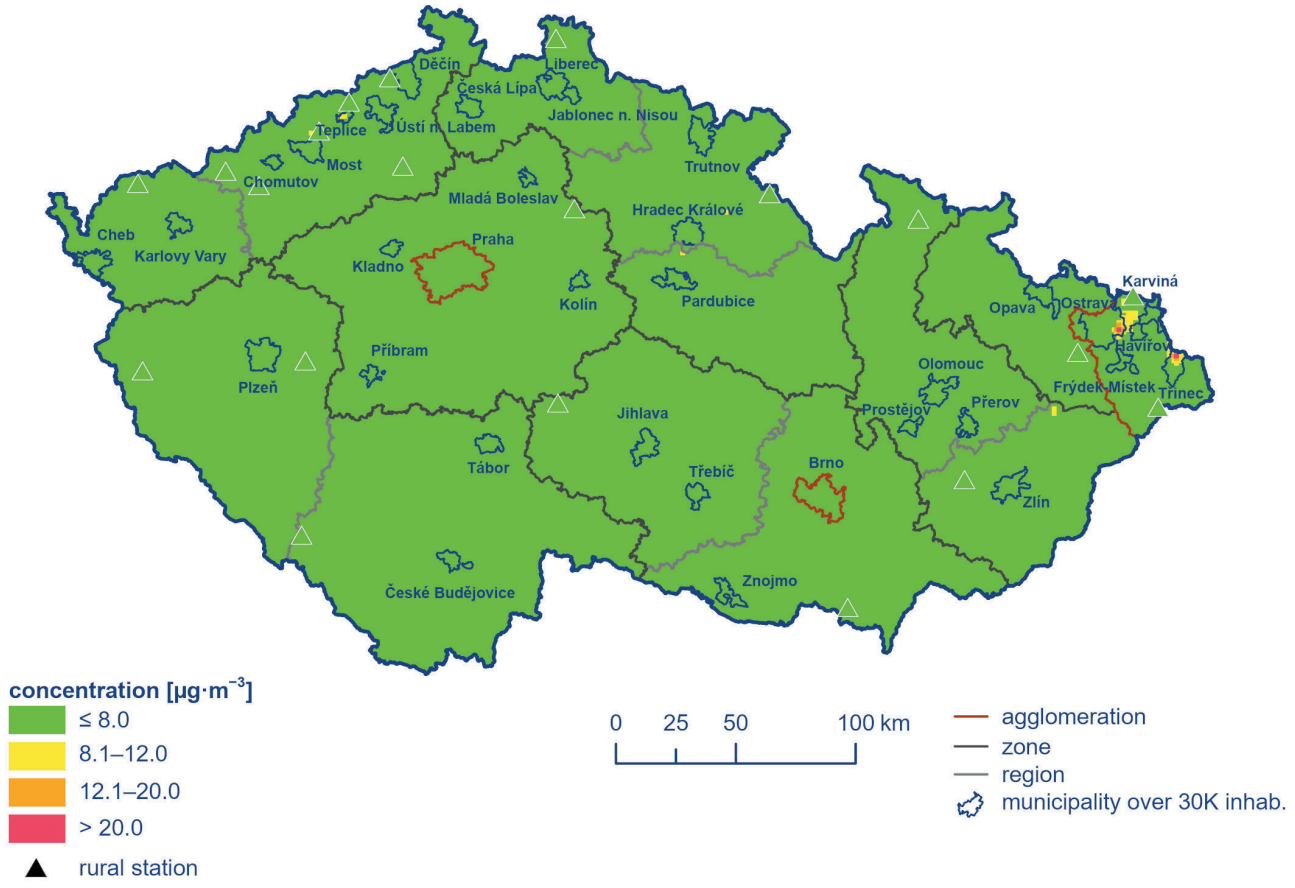

Fig. IV.7.4 Field of annual average SO_2 concentration in winter of 2021/2022

IV.7.2 Trends in sulphur dioxide concentrations

A substantial reduction in SO_2 concentrations occurred after 1998 in connection with Act No. 309/1991 Coll. coming into effect and ensuring compliance with the prescribed emission limits.

In the period 2011–2021, until 2016 a decreasing trend is evident at nearly all stations (Fig. IV.7.5). In 2017, the decrease was interrupted and in 2018 resumed at most locations. In 2019, 2020, and 2021, a slight decrease in SO_2 air pollution characteristics continued. This decrease is evident at most stations at both the fourth highest 24-hour and the 25th highest hourly SO_2 concentrations. On the contrary, the increase is clear in 2020 at the Lom station (Fig. IV.7.5). As already mentioned, the influence of industrial resources can predominantly be expected at the Lom station. In 2021, SO_2 concentrations at this station decreased compared to the previous year.

In evaluating trends in hourly and 24-hour SO_2 characteristics at individual types of stations in the CR according to the classification (Obr. IV.2), there was a significant increase identified in concentrations of this substance for both the characteristics in 2011 and 2018 at industrial stations in the Ostrava/Karviná/Frýdek-Místek agglomeration (Fig. IV.7.6 and IV.7.7)[1]. This increase was affected by concentrations observed at the Ostrava stations arising from remediation activities on the waste lagoons of the former OSTRAMO company. In 2019, the increase did not continue, on the contrary, there was a decrease in SO_2 concentrations, which was reflected in 2020 mainly in observations of urban, suburban and regional stations (Fig. IV.7.6 and Fig. IV.7.7). In 2021, this decrease was even more noticeable at almost all types of stations and in general in the average at all stations (Fig. IV.7.6 and Fig. IV.7.7).

The annual and winter averages show a clear decrease in SO_2 concentrations since 2017 until 2021 (Fig. IV.7.8). This decrease is apparent in all rural localities as well as in the category of regional localities. The 10-year annual and winter average (2011–2020) has a stable trend, with the winter average at a slightly higher level (Fig. IV.7.8).

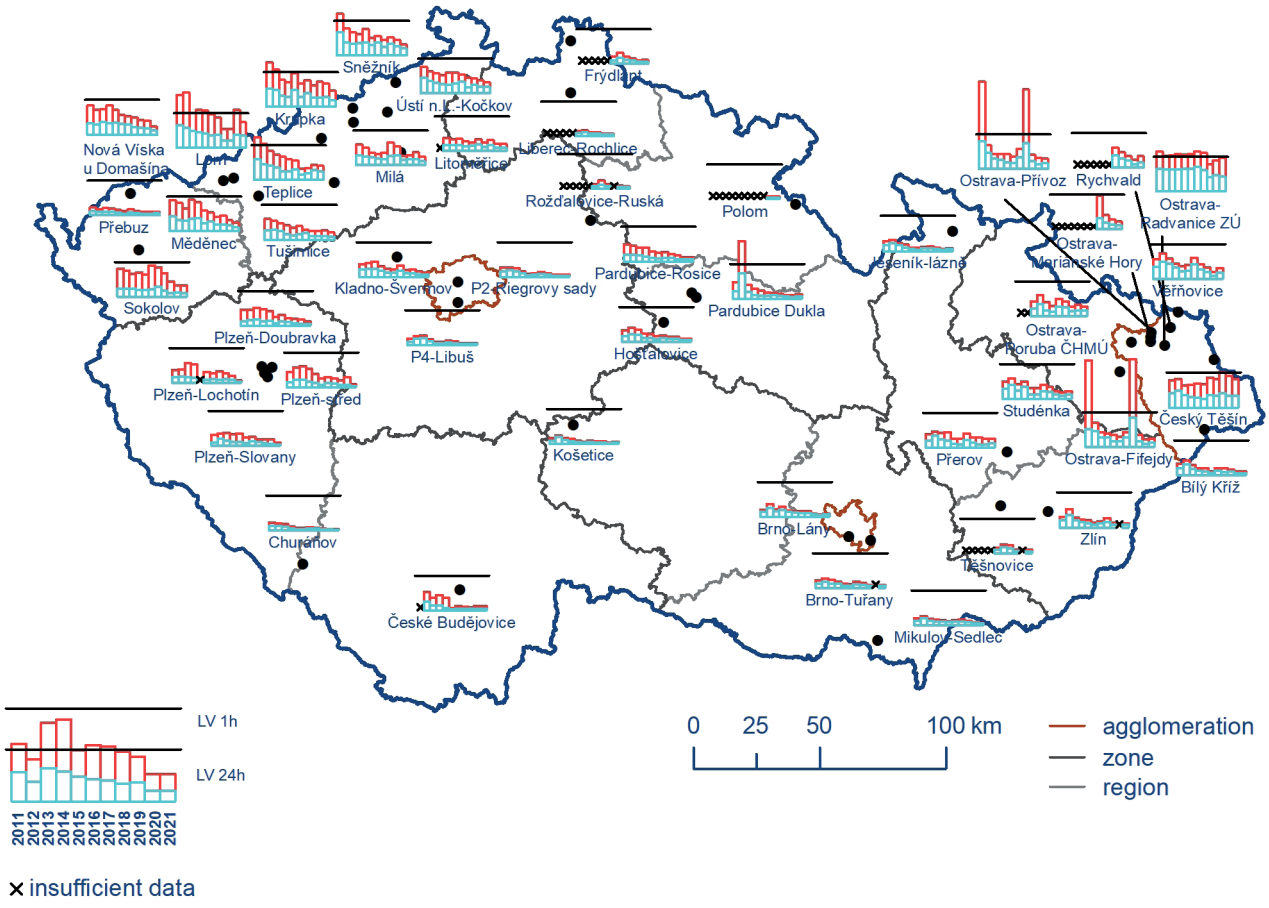

Fig. IV.7.5 4th highest 24-hour and 25th highest hourly SO_2 concentrations at selected stations, 2011–2021

1 Within the group of industrial stations, industrial stations in the O/K/F-M agglomeration were distinguished from industrial stations in the Ústí nad Labem region (ULK), which are operated by ČEZ a. s., and are located at the outskirts of small municipalities and in places outside settlements. The Ostrava stations, in particular, tend to be significantly affected by industry, while stations in the Ústí nad Labem region characterize rather the industrial background of the Krušné hory foothill area.

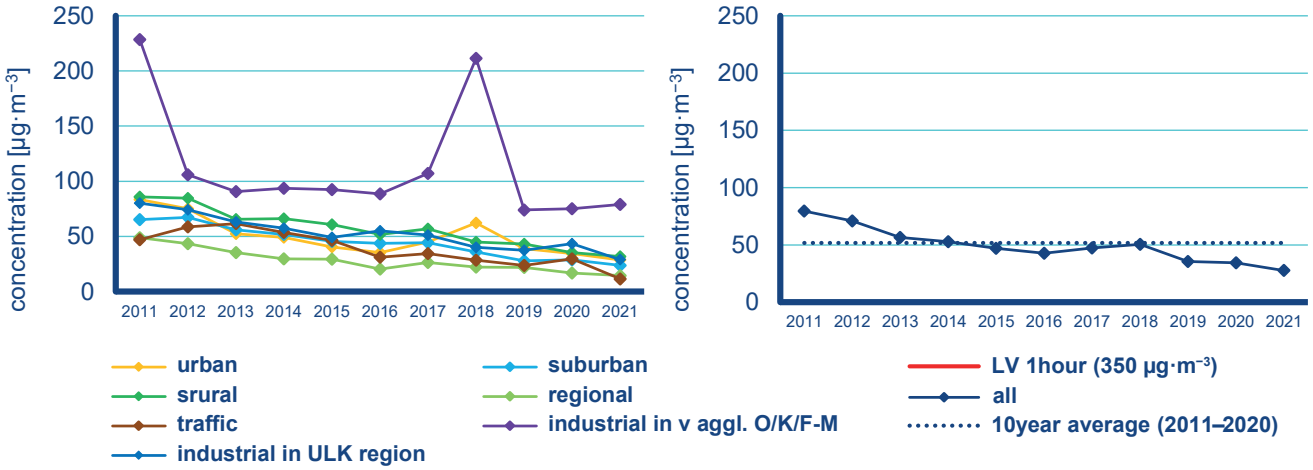

Fig. IV.7.6 25th highest 1-hour SO_2 concentrations at particular types of stations, 2011–2021

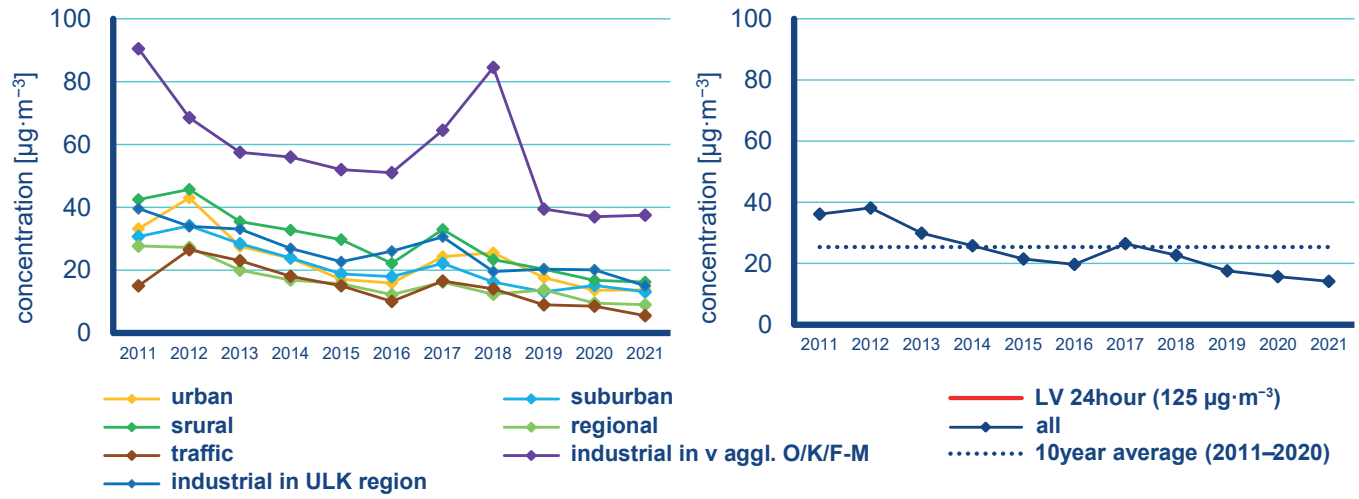

Fig. IV.7.7 4th highest 24-hour SO_2 concentrations at particular types of stations, 2011–2021

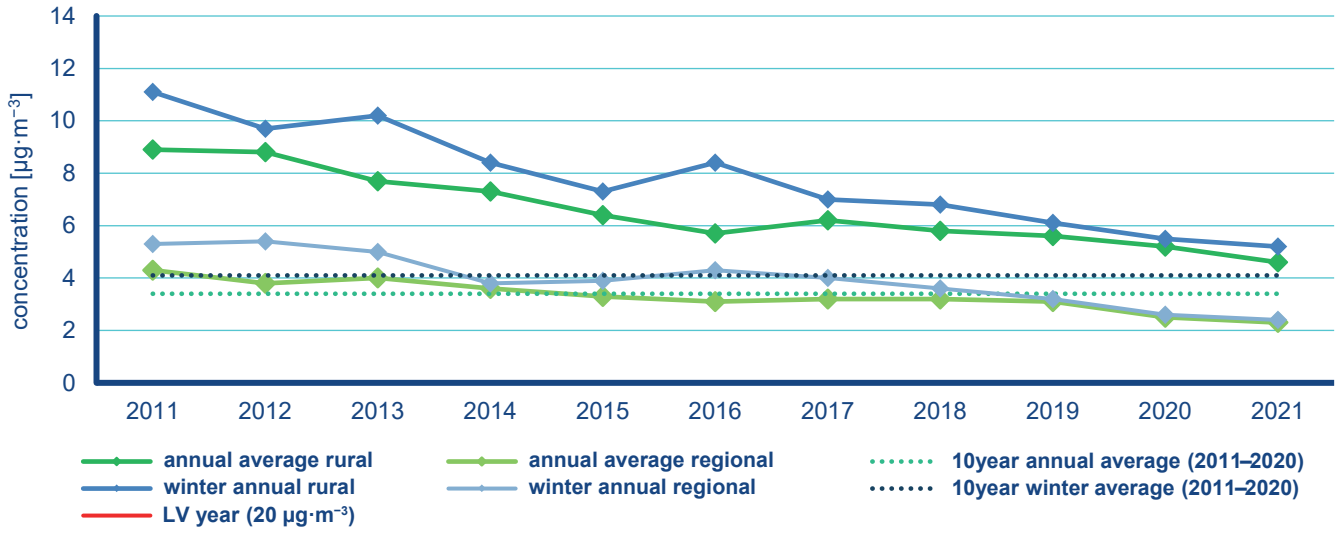

Fig. IV.7.8 SO_2 concentrations at particular types of stations, 2011–2021

The overall decreasing trend in SO_2 concentrations follows a reduction in emissions due to sulphur removal in coal-fired power plants and a change in the fuel types in use (see the emission trends in Chap. II). The varying meteorological and dispersion conditions in particular years also had an impact on the year-on-year variations in SO_2 concentrations.

IV.7.3 Sulphur oxide emissions

Sulphur oxide emissions originate mainly from the combustion of solid fossil fuels containing sulphur. In 2020, at a national scale, 39.4 % of SO_x emissions originated from sector 1A1a – Public electricity and heat production, and 21.6 % from sector 1A4bi – Residential: Heating, water heating, cooking (Fig. IV.7.9). Other more important sectors include combustion processes in industry (processing of mineral raw materials, chemical industry, processing of solid fuels, or food production). A reduction in SO_2 emissions in the 2010–2020 period took place after 2012 as a result of preparations at sources for stricter emissions limits (Fig. IV.7.10). In view of the predominant effect of the sector of public electricity and heat production, SO_x emissions appear mostly in the Ústí nad Labem, Moravian-Silesia and Central Bohemia regions, in which the larger energy production facilities are located (Fig. IV.7.11).

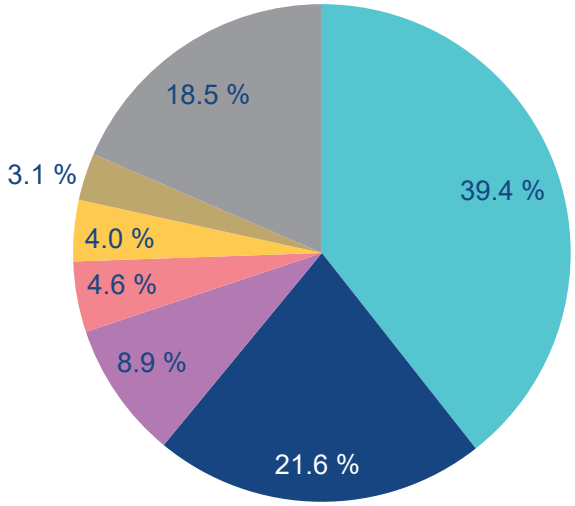

Fig. IV.7.9 Proportion of NFR sectors to total SO_2 emissions, 2020

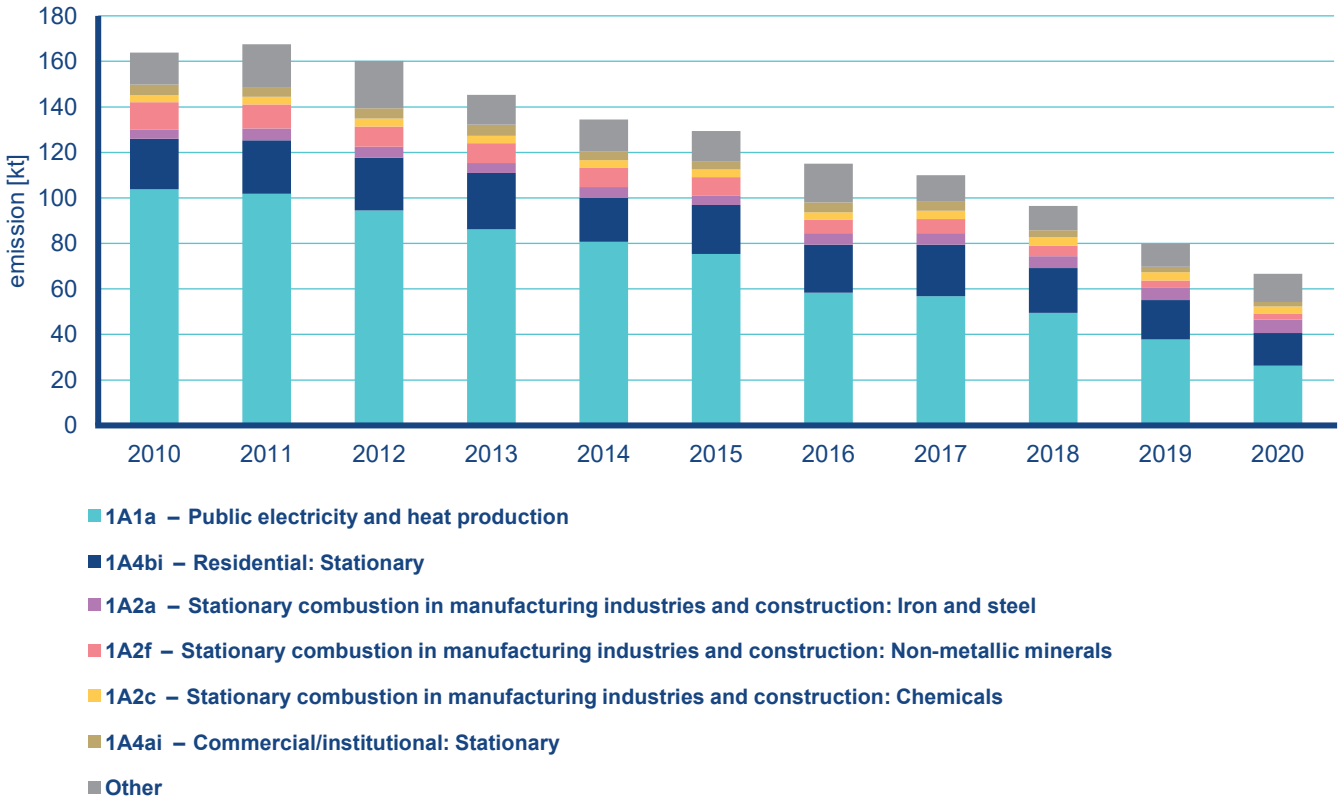

Fig. IV.7.10 Total SO_2 emissions, 2010–2020

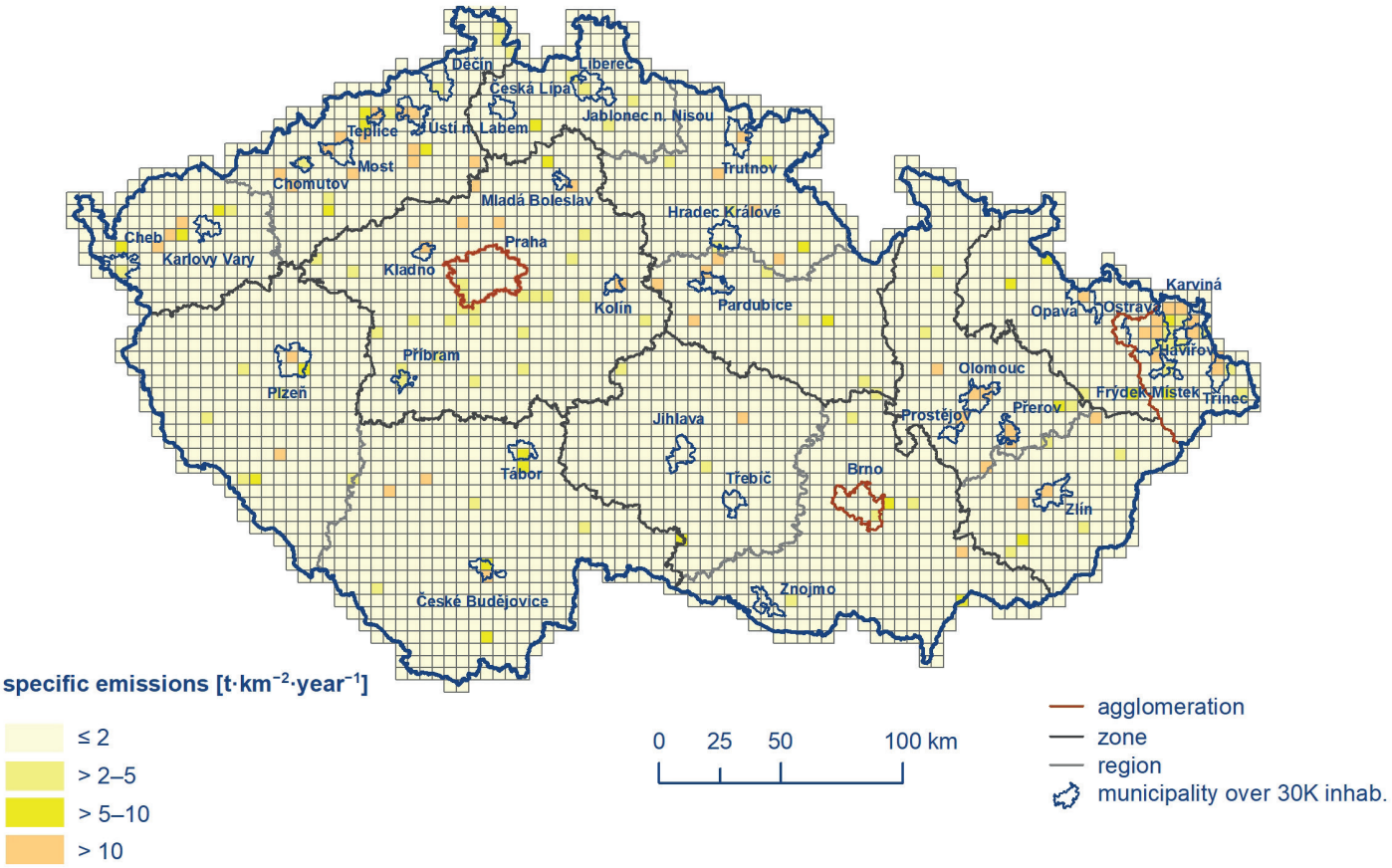

Fig. IV.7.11 Total SO_2 emissions in 5×5 km spatial resolution squares, 2020