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THE INFLUENCE OF COVID-19 ON PARTICULATE MATTER CONCENTRATIONS IN A MEDIUM-SIZED TOWN

ABSTRACT

The pandemic caused by the coronavirus COVID-19 is having a worldwide impact that affects health, economy and air pollution in cities indirectly. In Slovenia, as well as in all other countries, the number of cases of infected people increased continually in 2020, which affected the health system and caused movement restrictions, which, in turn, affected the air pollution in the country. This article presents the indirect effect produced by this pandemic on air pollution in Maribor, Slovenia. Traffic and air quality data were used to perform the evaluation, in particular PM_{10} and $PM_{2.5}$ daily concentrations from the monitoring station in Maribor. By observing the detailed traffic data and particulate matter concentrations acquired in the Maribor city centre before and during the pandemic times, we show the influence of COVID-19 on particulate matter concentrations in that part of the town. The results show slightly lower particulate matter concentrations, which could be explained by the significantly lower traffic volume values in the lockdown months.

KEYWORDS

PM_{10}; $PM_{2.5}$; COVID-19; traffic; particulate matter.

1. INTRODUCTION

Air pollution has become a critical threat to the environment, as well as a cause of serious threats to human health. About 80% of people in urban areas are exposed to air pollution exceeding the air quality standard value set by the World Health Organization (WHO), and 98% of cities in low-middle income countries and 56% in high income countries do not meet the WHO guidelines [1]. Particulate matter with a diameter less than 10 µm (PM_{10}) can cause serious health problems due to its small size. Particles of this type can penetrate deep into the lungs, and impose significant risks to the respiratory and cardiovascular systems [2]. Although the sensitivity of individuals may vary with their general health and age, high concentrations of PM_{10} affect the whole population. According to EU legislation [3], the concentration of PM_{10} particles should not exceed 50 µg/m^3 more than 35 times in a year, while guidelines for protecting human health are even stricter, by recommending an annual mean value of 20 µg/m^3 [4]. However, despite the successful legislation, a large part of Europe's and the world's population is, unfortunately, still breathing air with pollution levels that exceed the Air Quality Guidelines as defined by the WHO [5].

Coronaviruses are a diverse group of viruses infecting many different animals, and they can cause mild to severe respiratory infections in humans. In 2002 and 2012, respectively, two highly pathogenic coronaviruses with zoonotic origin, Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) and Middle East Respiratory Syndrome Coronavirus (MERS-CoV), emerged in humans, and caused fatal respiratory illness, making the emerging coronaviruses a new public health concern in the twenty-first century [6]. At the end of 2019 and at the beginning of 2020 the world was hit by the novel coronavirus, designated as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) [7]. SARS-CoV-2 emerged in the city of Wuhan, China, and caused an outbreak of unusual viral pneumonia. Being a highly pathogenic, transmittable and invasive pneumococcal disease, this novel coronavirus disease 2019 (COVID-19), spread all over the world fast [8, 9].

COVID-19 was first reported in Slovenia on 4 March 2020. To prevent its propagation, the Slovenian government immediately declared a state of health emergency [10]. A set of rapid and strict countermeasures were taken, including locking down cities, limiting the population's mobility, and prohibiting almost all avoidable activities. Also, in March 2020, a world pandemic was declared by the WHO [11]. At that time, all Slovenian cities were locked down, and the majority of industrial and commercial companies were forced to stop their activities until further notice. The same restrictions were made for citizens; the authorities requested them to stay at home and not to leave it except for very specific reasons.

Due to all the mentioned restrictions, it was expected that the COVID-19 outbreak would play a significant role in air pollution. PM_{10} concentrations, in general, have an influence on the air quality. Bad air quality, especially PM_{10} particles, imposes significant risks to human health and the well-being of individuals in general [12]. In this paper, we show the influence of COVID-19 on PM_{10} concentrations in the Maribor city centre before and during the pandemic times. The acquired data were observed using the visualisation and analytics tool for multi-dimensional data presented in [13]. From the obtained results we can suggest various adjustments and modifications in that part of town to reduce PM_{10} concentrations, and, thereby, improve residents' health [14].

The remaining part of the paper is organised as follows. In Section 2, the related work is presented, while Section 3 contains a description of data capturing, data and the used methods. Section 4 presents the obtained results. After the discussion in Section 5, the paper's conclusion is given in Section 6.

2. RELATED WORK

In recent months, the interrelationship between COVID-19 and the environment has been an emerging research topic. There has been a flood of papers on the topic of COVID-19 in connection with environmental degradation, air pollution, climate/meteorological factors and temperature [15]. Wang and Su reported a significant reduction of air pollution due to the full or partial lockdown in the short run, but the study does not support the reduction of greenhouse gas emissions (GHG) in the long run [16]. In [17] the authors present the improvement of air quality, breaches and reduced noise levels because of COVID-19, and GHG reduction in a shorter time period. Saadat et al. reported the improvement of air and water quality worldwide, but, on the other hand, the generation of a large amount of medical waste [18].

The authors in [19, 20] presented the significant influence of average and minimum temperatures, as well as the air quality, on COVID-19 transmissions. Sahin presented a positive correlation between wind and COVID-19 cases in Turkey [21]. Qi et al. and Gupta et al. showed the notable negative influence of temperature and humidity on daily cases of COVID-19, while, in the US, the prediction of COVID-19 transmissions by temperature and humidity is possible [22, 23]. Sobral et al. presented that countries that have higher rainfall experienced an increase in COVID-19 transmissions [24].

Abdullah et al. found a significant influence of the movement control order in Malaysia on the reduction of particulate matters, especially $PM_{2.5}$ [25]. Authors from Rio de Janeiro, Brazil, and Barcelona, Spain, reported CO reduction during the lockdown period, and, in parallel with the mentioned reduction, there was also a decrease in NO_2 and PM_{10} [26]. While CO, NO_2 and PM_{10} have decreased, O_3 increased by more than 50% during the lockdown [27]. An air pollution reduction by 30% and mobility reduction by 90% during COVID-19 lockdowns have been reported by Muhammad et al. [28]. In the major cities of central China, the source of the new SARS-CoV-2, the concentrations of $PM_{2.5}$, PM_{10}, SO_2, CO and NO_2 reduced by 30.1%, 40.5%, 33.4%, 27.9% and 61.4%, respectively, during the COVID-19 lockdown [29]. Moreover, Jain and Sharma stated that the maximum reduction happened in the case of $PM_{2.5}$ in most regions in India. The concentrations of $PM_{2.5}$, PM_{10} and NO_2 declined by 41%, 52% and 28%, respectively, in six megacities in India [30]. Bacak and Toros [31] showed that, in the months with restrictions in Istanbul and Ankara, PM_{10} concentrations decreased due to the lack of use of vehicles, industrial activities and fuel consumption. The lack of car transportation in Krakow, Poland, led to the recognition that the latter is responsible for up to 20% of the PM_{10} carbon fraction concentrations [32]. The study presented in article [33] investigated the concentrations of the air pollutants (NO, NO_2, NO_x, SO_2, CO, O_3, PM_{10} and $PM_{2.5}$) on three sites before, during, and after the COVID-19 lockdown. The air quality improved significantly in terms of CO and NO_2 concentrations. On the other hand, there were increased concentrations of O_3 and SO_2, while PM_{10} concentrations decreased by 22%. Shukla et al. [34] also measured the influence of the lockdowns on three different sites. The levels of $PM_{2.5}$ showed significant increases of 525.2%, 281.2% and 185% at sites in comparison to its concentration in the lockdown phase.

Some studies concluded that the reduction in pollutant concentrations (PM_{10}, $PM_{2.5}$, SO_2 or NO_2), can be attributed mainly to the measures that have limited civic logistics and industrial activities. However, some activities or phenomena have not changed during, or as a result of, the lockdown. For instance, air quality reports from Colombia concluded about the excessively bad air quality at the beginning of the COVID-19 lockdown [36]. The results show the impact of the partial lockdown on air quality in an urban and industrial area of northern Colombia. The particulate matter concentrations in the industrial area did not disclose significant changes in the averages of PM_{10} and $PM_{2.5}$. An opposite pattern was evidenced in the urban area, where a significant decrease in PM_{10} and $PM_{2.5}$ averages was detected during the COVID-19 lockdown [35]. The authors in [36] and [37] declared that they could not clearly determine the influence of lockdowns on air pollutants.

3. METHODOLOGY

3.1 Data capturing

The data used in the presented study were acquired using a monitoring system that was established in 2013 as part of the PMinter project. The monitoring station was located in the Maribor city centre (direction west-east, as shown in *Figure 1*). It was around 6 m from the centre of the road (a straight one way street (no intersections), a two lane road) [14].

PM_{10} concentrations were measured using laser aerosol spectrometry. A laser with a 660 nm wavelength was used according to the EN 12341 standard. The device delivered particle counts in 31 size channels, and was able to conduct measurements in the range from 0.1 to 10,000 $\mu g/m^3$. The data were gathered continuously from 1 January 2013, with the exception of short intervals (a maximum of 2–3 weeks per year) due to the maintenance and calibration work conducted on the sensory system. On average, the temporal resolution of the system was 1 minute [14].

3.2 Data

In addition to particulate matter ($PM_{2.5}$ and PM_{10}), the sensory system measured traffic volume data simultaneously, using induction loops installed within the roadway. The presence of a vehicle and its speed were measured using inductance footprints obtained with the inductive loops, and the data were

Figure 1 – The point represents the location of the monitoring system in Maribor, while the line represents the closed Koroška cesta

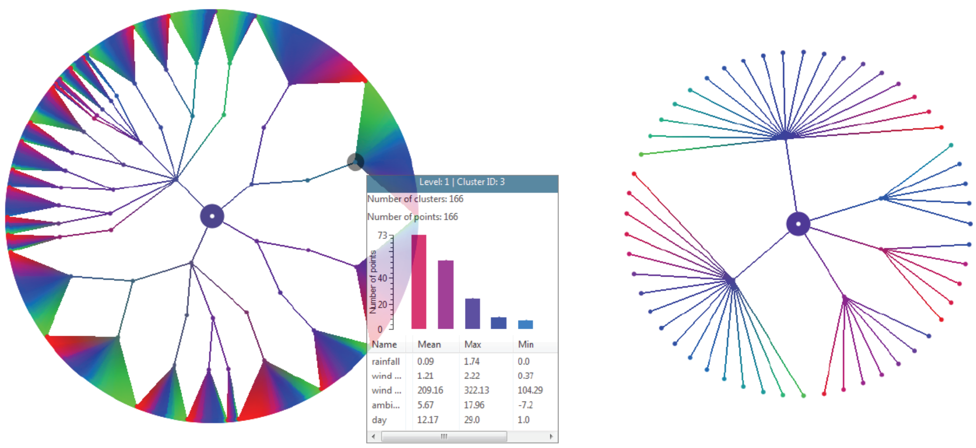
aggregated with a 15 min temporal resolution (i.e. by counting the number of vehicles and estimating their average speed). In each road lane there were two induction loops, and the speed of the vehicle was determined by the matching imprint of the induced voltage and the time it took the vehicle to travel from one loop to the other. Finally, the acquired data were combined with weather data using a 1 hour temporal resolution. The weather data include measurements of wind direction, atmospheric pressure, wind speed, rainfall, ambient temperature and relative humidity [14]. A description of the captured data, used units, and the ranges of collected data are presented in *Table 1*. In total, 78,840 hourly measurements were used in the present study (excluding leap years and maintenance). Of these, 6,864 hourly measurements were in the time of lockdown periods (the first lockdown was from 12 March 2020 to 14 May 2020 and the second one was from 18 October 2020 to 31 May 2021 [11]).

Table 1 – Description of captured data

Measured parameter	Units	Range
$PM_{2.5}$	μg/m^3	[1.8, 128.4]
PM_{10}	μg/m^3	[2.3, 160.5]
Vehicle speed	km/h	[2, 69]
Traffic volume	vehicles/day	[69, 12583]
Wind direction	°	[0, 360]
Wind speed	m/s	[0, 8.4]
Atmospheric pressure	hPA	[943.5, 1011.4]
Rainfall	mm	[0, 44.9]
Ambient temperature	°C	[-15.3, 41.4]
Relative humidity	%	[15.5, 97.9]

3.3 Analytics tool

Every empirical study requires proper data preparation for further examination and knowledge discovery. In the presented case, the data were structured in a spreadsheet, where each row represents an individual entry, which is treated as a multi-dimensional point, while the number of columns represents the dimension of the point [13]. As the tool serves for the observation of all kinds of data, the dimensionality of the point depends strictly on the data themselves (e.g. if the observed data have 10 different attributes, the dimensionality would be 10, whereas, on the other hand, if the data have 150 different attributes, the dimensionality of a point will be 150). In the presented article, each measured value (from $PM_{2.5}$ to relative humidity) serves as a separate dimension. In some cases it is possible that data have too many dimensions (again, it depends on the data themselves). Dimensionality reduction using principal component analysis was performed to get only a small number of important dimensions. This was achieved by mapping data to the new space, where the dimensions were arranged according to the maximal dispersion of data, from those with the largest to the smallest ones [38]. In the next, final step of data preparation, the mapped data were clustered hierarchically into clusters on different levels (see *Figure 2*). At the lowest level, the multi-dimensional points were compared and clustered by distance. When we determined clusters to all points, the second level of the hierarchy was created, where the clusters from the first level were grouped to the larger clusters by the same criteria as before. The highest level of hierarchy was a single cluster that contained all the data in the dataset



a) *b)*

Figure 2 – a) the whole cluster hierarchy of the observed data, b) randomly selected cluster

[39]. By clustering, similar/related data are united in individual clusters, meaning that the data captured in specific conditions (e.g. rainy weather, different seasons of the year) were gathered in one place. The statistics presented in the continuation can be applied, and new knowledge can be discovered in the clusters.

Data prepared in the described way are ready for visualisation and further analysis. In *Figure 2a* the visualisation of the whole cluster hierarchy is presented (a different colour means a different value of the measured particulate matter), including a box with the basic statistics, while *Figure 2b* shows the randomly selected cluster from the third level of the hierarchy. In both cases in *Figure 2* the centre of the circular data displays the cluster at the highest level (the one that contains all the data from the input dataset). The more we move from the centre towards the edge of the circle, the lower we go in the cluster hierarchy. The individual multi-dimensional points are presented on the edge of the circle. The presented tool includes a great number of statistics and metrics (the average value, median, maximum frequency of individual value, variance, standard deviation, minimum and maximal values, Pearson and Spearman correlations, the distance correlation, the randomised dependence coefficient, the maximal information coefficient, skewness and kurtosis, the P value and the Fisher test), filtering data by individual variables or their values, and calculation of their probability density function [13]. Some of these functionalities can be seen in *Figure 3*, such as a network representation of the correlations between dimensions (measured values), where the dependent variable (PM_{10}) is coloured in yellow, while the blue nodes represent explanatory variables that are connected directly to the dependent one. The edges between the nodes indicate the correlations, where the green colour represents a positive, and red a negative correlation. The intensity of the colour (green or red) represents the value of the correlation (less intense means less correlation, and vice versa). In *Table 2* some statistics/metrics about the data used in this paper are shown. All the presented metrics,

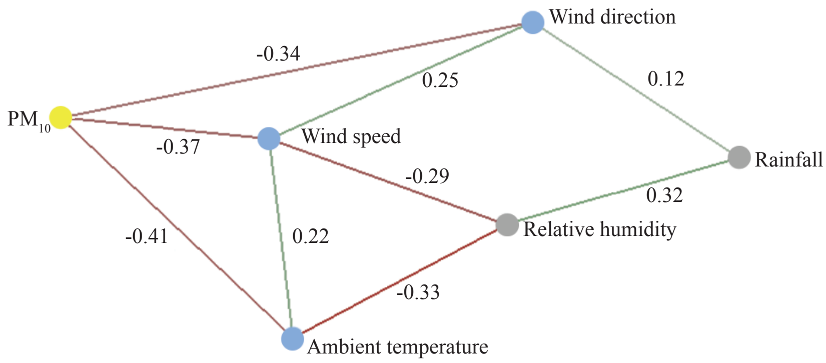


Figure 3 – Network representation of the correlations between variables

Table 2 – Some statistics/metrics about the data used in this paper (total available period from 1 January 2013 until 31 December 2021)

Attribute name	Mean	Median	Mode	Variance	Std.	Min	Max	Pearson	Spearman	dCor
Traffic	340.41	380.19	415.5	9522.3	97.58	17.25	519.71	0.05	0.03	0.08
Speed	32.58	30.42	28.92	21.82	4.67	18.63	43.0	-0.01	0.0	0.06
Wind speed	1.26	1.2	1.03	0.25	0.5	0.08	3.56	-0.37	-0.37	0.38
Wind direction	209.48	209.06	216.54	2172.74	46.61	42.17	336.38	-0.34	-0.33	0.32
Ambient temperature	11.64	12.26	6.67	63.9	7.99	-7.2	30.63	-0.41	-0.36	0.46
Relative humidity	73.8	74.19	66.79	173.41	13.17	35.48	101.75	0.21	0.17	0.24
Rainfall	0.12	0.0	0.0	0.1	0.31	0.0	3.61	-0.21	-0.29	0.26
Atmospheric pressure	985.48	985.44	984.4	53.7	7.33	948.18	1007.05	0.19	0.16	0.22

such as correlations, were calculated according to the dependent variable (the dependent variable, in our case, was particulate matter). It is the same for the highest cluster in the hierarchy as for any other selected cluster, the previously mentioned statistics and metrics can be seen at any level. In addition to the circular display of the data hierarchy, the presented tool also provides a network display of the correlations between dependent and explanatory variables (*Figure 3*). The results presented in the next Section were obtained using the described tool.

4. RESULTS

The results in the continuation have been produced on an AMD Ryzen 5 4500U with 32 GB of main memory on Windows 10. The results shown in *Figures 4 and 5* represent the average monthly values from the beginning of 2013 until the end of 2021. In *Figures 4 and 5* the red chart line with the rectangular marker represents the data obtained in 2020, while the orange line with the triangular marker represents the data obtained in 2021. We can see that there are no big deviations in PM_{10} and $PM_{2.5}$ concentrations in 2020 and 2021, where two lockdown periods occurred in Maribor, and in Slovenia in general. The first lockdown period was from 12 March 2020 to 14 May 2020, and the second one started on 18 October 2020 and continued into 2021, where, on 31 May 2021, the pandemic was suspended.

Figures 6 and 7 show the PM_{10} and $PM_{2.5}$ concentrations only in the lockdown months. For the period from 2013 to 2019 the average value of the average monthly concentrations was used, while the monthly average values were used for the years 2020 and 2021 (when both lockdowns occurred). In all the observed lockdown months, the particulate matter concentrations were lower than the seven-year average. Months such as March, April and May in 2020 are the period of the first lockdown, while other months (October, November and December in 2020 and January, February, March, April and May in 2021) are the months of the second lockdown.

Figure 8 represents the comparison of yearly average values of PM_{10} and $PM_{2.5}$ from 1 January 2013 to 31 December 2021.

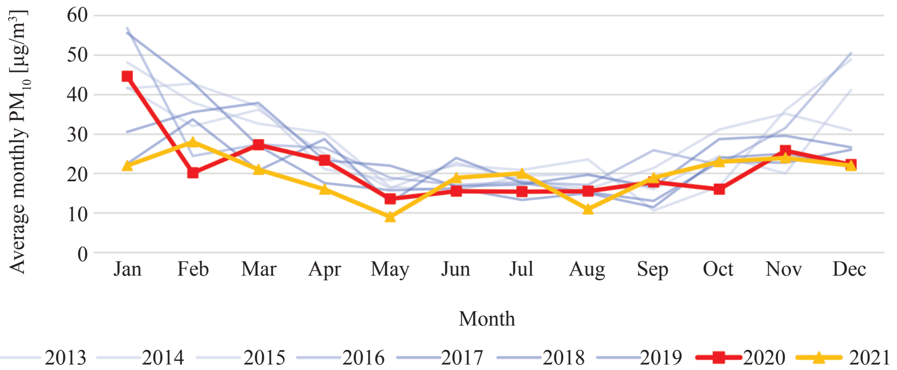


Figure 4 – Average monthly PM_{10} concentrations from 1 January 2013 until 31 December 2021

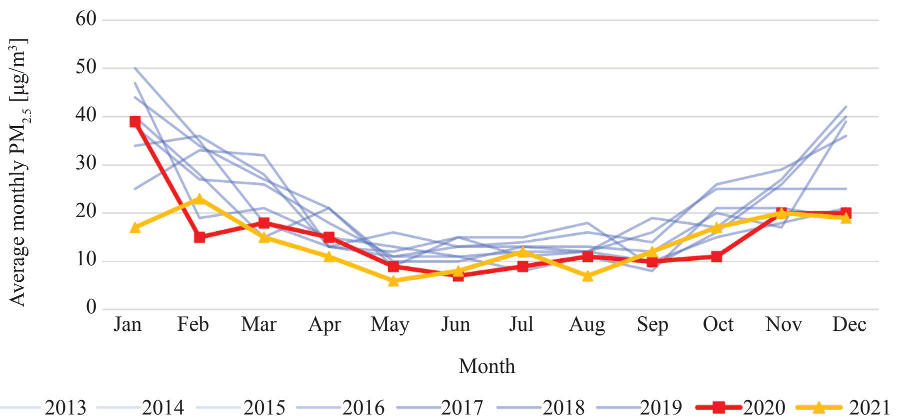
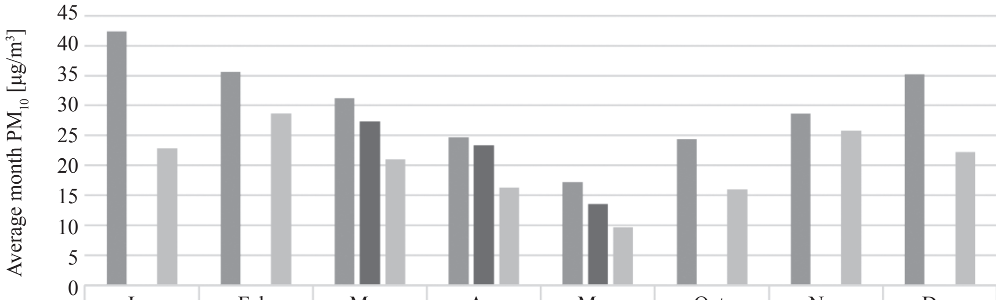


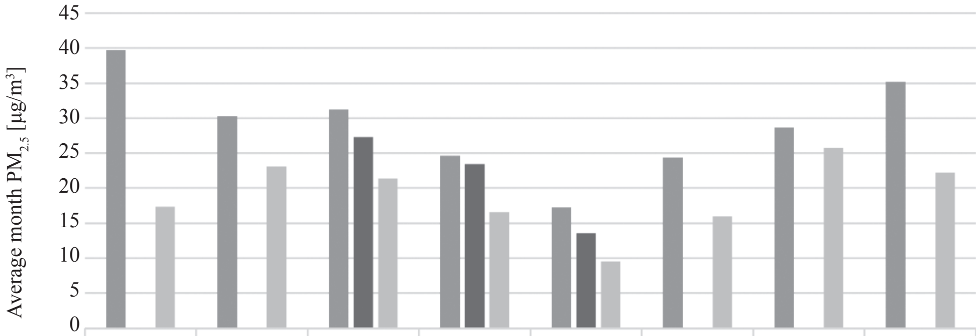
Figure 5 – Average monthly $PM_{2.5}$ concentrations from 1 January 2013 until 31 December 2021



	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec
2013-2019	42.43	35.67	31.25	24.66	17.21	24.33	28.62	35.18
Lockdown 1			27.29	23.39	13.54			
Lockdown 2	22.84	28.69	21.01	16.31	9.62	15.96	25.76	22.25

Lockdown months

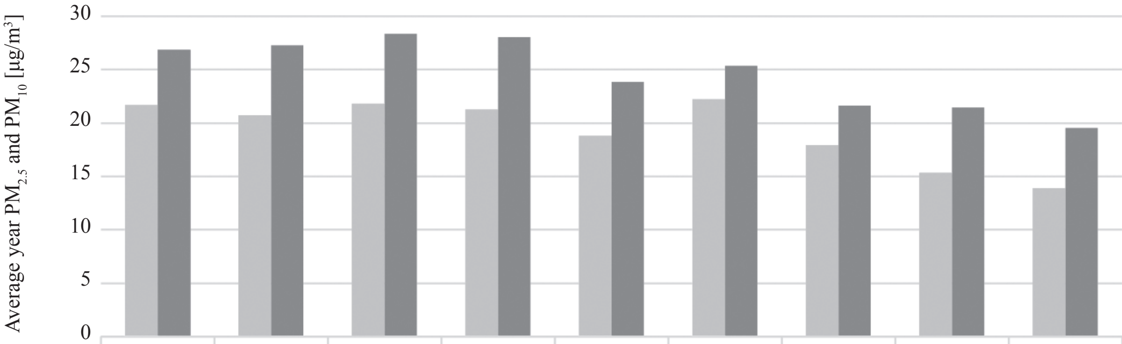
Figure 6 – Average monthly PM_{10} concentrations during the lockdown months (in 2020 and 2021) in comparison to the average monthly concentrations for the period from 2013 to 2019



	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec
2013-2019	39.71	30.28	31.25	24.66	17.21	24.33	28.62	35.18
Lockdown 1			27.29	23.39	13.54			
Lockdown 2	17.32	23.07	21.34	16.53	9.53	15.96	25.76	22.25

Lockdown months

Figure 7 – Average monthly $PM_{2.5}$ concentrations during the lockdown months (in 2020 and 2021) in comparison to the average monthly concentrations for the period from 2013 to 2019



	2013	2014	2015	2016	2017	2018	2019	2020	2021
$PM_{2.5}$	21.66	20.75	21.83	21.25	18.83	22.25	17.91	15.33	13.91
PM_{10}	26.86	27.27	28.33	28.02	23.86	25.37	21.65	21.44	19.5

Lockdown months

Figure 8 – Comparison of the yearly average $PM_{2.5}$ and PM_{10} concentrations

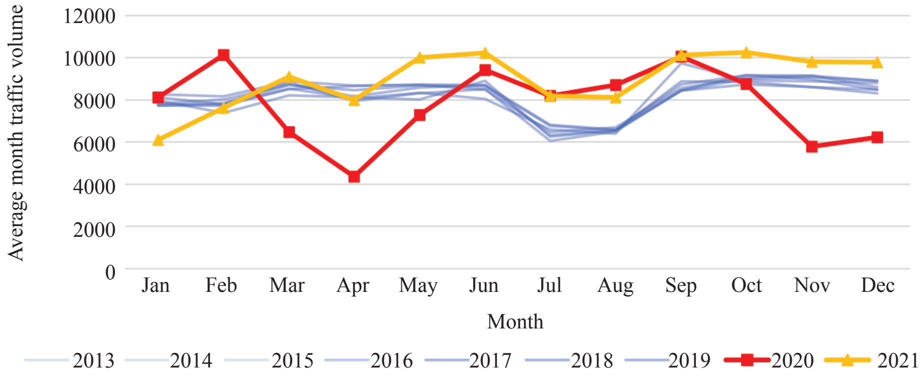


Figure 9 – Average monthly traffic volume from 01.01.2013 until 31.12.2021

In *Figure 9* we can observe the average monthly traffic volumes from 1 January 2013 until the end of 2021. Unlike PM_{10} concentrations, *Figure 9* shows some deviations in 2020 and 2021 in comparison to other years.

5. DISCUSSION

By observing the network display of the correlations (*Figure 3a*) between the dependent (particulate matter) and explanatory variables, we can observe the highest correlation with the ambient temperature, as has already been proved by Papanastasiou et al. [40]. Turbulent air caused by traffic, although not a source of emissions, can impact pollutant concentrations [41]. This effect is related to vehicle speed [42]. On the other hand, wind direction can be linked to the PM_{10} concentration under non-homogeneous spatio-temporal PM_{10} emission conditions [43], and it has a major part in the transport, dilution and re-suspension of air pollutants [44], while Stadlober et al. [45] and Hörmann et al. [46] proved that low wind speeds lead to higher ambient PM_{10} concentrations, regardless of the traffic conditions. Relative humidity is an important explanatory variable for spring, and hygroscopic aerosol mass concentrations depend on it [47]. Finally, rainfall washes out part of the particulates from the atmosphere during precipitation [14, 48].

In general, from *Figures 4 and 5* we can observe higher PM_{10} and $PM_{2.5}$ concentrations in colder months, which was the result of more frequent use of heating systems (especially those powered by wood) [49], and also a consequence of temperature inversions. They are one of the main reasons for the pollution in Maribor [14]. From *Figures 4, 5 and 8* we can also observe the descending trend in concentrations in the city of Maribor across the years. We assume that the reason behind this is global warming (higher winter temperatures), as presented by Scheinhardt et al. [50], and another one is the more frequent use of electric cars and cars with lower exhaust emissions [51]. Another assumption is that there are also more houses with new/better thermal insulation and more efficient heating systems (also minor use due to better insulation) [52]. Additionally, the graphs in *Figures 6 and 7* also confirm the already mentioned findings from *Figures 4, 5 and 8*, that there was a descending trend of particulate matter concentrations in the city of Maribor, Slovenia.

As already mentioned in the previous Section, in *Figure 9* we can observe some deviations in traffic volume in 2020 and 2021. We speculate that there were two main reasons for such behaviour. On the one hand it was a consequence of the lockdowns (the whole country was closed, meaning most of the industry, schools, public transport and many more) due to the COVID-19 pandemic. We can see lower values in March, April and also May for the year 2020 as an effect of the first lockdown, and decreased values in October, November and December in 2020 and January, February, March and April in 2021 due to the second lockdown. The lack of traffic due to lockdowns has also been presented by Bacak and Toros [31] and Zareba and Danek [32] in Istanbul, Ankara and Krakow. On the other hand, we have some months in 2020 with increased traffic volume, such as February, and the whole time between both lockdowns (June, July, August and September in 2020). The similar can also be observed in 2021 from May onwards. We speculated that the main reason behind those higher traffic volume values was the closure of Koroška cesta in the city centre of Maribor. Due to this closure the traffic was rearranged in the city of Maribor, and part of it was led past the PM_{10} and $PM_{2.5}$ concentrations measuring station. By taking this fact into account, closure of the road also means more traffic in lockdowns near the measuring station, and consequently, higher particulate matter values than there were without the road closure. As mentioned before, there are no outstanding average monthly values in PM_{10} and $PM_{2.5}$ concentrations in *Figures 4 and 5*, but we observed lower traffic volumes in the lockdown months (*Figure 9*). The difference comes as a consequence of people staying at home during lockdowns and producing more particulate matter with heating systems (notably in the winter months).

The results also show that the closure of the Koroška cesta had an impact on the traffic past the measuring station, but it does not solve the traffic problem in the city centre. High monthly traffic volumes also indicate the need for necessary change in traffic volumes, which can be achieved by means such as restrictions for the old vehicles in the city centre and increased use of public transport.

In the case of the closure of public life due to COVID-19 restrictions we had special circumstances where traffic decreased, and we were able to observe the impact of this decrease on air quality. Usually, it is impossible to carry out such experiments in reality, but now we were offered the opportunity to observe the impact of lower traffic on air quality. The results show lower values of PM_{10} and $PM_{2.5}$ due to traffic reduction, but, on the other hand, people were staying at home during the heating season, and there was more pollution from that type of pollutant. We can also observe that the limitation of the traffic on days with high pollution could not be the right solution to reduce PM_{10} and $PM_{2.5}$ concentrations, as there are also other pollutant groups in Maribor centre and nearby surroundings, such as industry, heating and natural sources. This can also be observed in *Table 2*, as the Pearson correlation coefficient with particulate matter is only 0.05.

6. CONCLUSION

The influence of COVID-19 on air quality, especially particulate matter, in the city of Maribor, Slovenia, is presented in this paper. By processing, analysing and investigating the data captured from the beginning of 2013 until the end of 2021, we came to some general conclusions and, most importantly, conclusions that relate to the last year of observed data. We found out about the influence of COVID-19 on particulate matter concentrations in the observed city, and came to the following conclusions:

- there is the trend of decreasing particulate matter concentrations since the beginning of the measurements,
- the closure of Koroška cesta had a significant impact on the increased traffic past the measuring station,
- PM_{10} and $PM_{2.5}$ concentrations decreased during the COVID-19 lockdowns.

According to the results, the used visualisation and analytics tools are suitable for new in-depth research and knowledge discovery. The future directions of this work are aimed at extending the measurements used in this research with additional data, and then repeating the used approach to discover interesting new findings.

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VPLIV COVID-19 NA KONCENTRACIJE PRAŠNIH DELCEV V SREDNJE VELIKEM MESTU

POVZETEK

Pandemija, ki jo je povzročil koronavirus COVID-19, ima posledice po vsem svetu in posredno vpliva na zdravje, gospodarstvo ter onesnaženost zraka v mestih. Tako v Sloveniji kot tudi v vseh ostalih državah je število primerov okuženih v letu 2020 nenehno naraščalo. Vse to je *vplivalo na zdravstveni sistem in povzročilo omejitve gibanja ter posledično vplivalo na onesnaženost zraka v državi. Ta članek predstavlja posredni učinek omenjene pandemije na onesnaženost zraka v Mariboru, v Sloveniji. V raziskavi so bili uporabljeni podatki o prometu in kakovosti zraka, predvsem dnevne koncentracije PM_{10} in PM2,5 z merilne postaje v Mariboru. Z opazovanjem podrobnih podatkov o prometu in koncentracijah prašnih delcev, pridobljenih v središču Maribora pred in med pandemijo, prikažemo vpliv COVID-19 na koncentracije prašnih delcev v tem delu mesta. Rezultati kažejo nekoliko nižje koncentracije trdnih delcev, kar bi lahko razložili z bistveno nižjimi vrednostmi obsega prometa v mesecih popolnega zaprtja države.*

KLJUČNE BESEDE

PM_{10}; $PM_{2.5}$; COVID-19; promet; prašni delci.

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