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O 39. AIR POLLUTION DATA ANALYSIS OVER VAN CITY

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ABSTRACT: Air pollution exhibits a very complex and non-linear behaviour as a result of positive and negative changes in time and space, depending on the meteorology and topographic structure, in the transportation of the emissions released into the receiving environment as a result of the activity of air pollution sources. The aim of the study is to monitor the behaviour of air pollutants over VAN in 2019 through statistical analysis of data, to contribute to increasing air quality. PM_{10} and SO_2 parameters have been observed to have the highest average hourly value of 72.5-25.1 µg / m³, and the lowest value (24.8 µg / m³ at 22:00 hours,11.4 µg / m³ at 16:00 hours) respectively. It can be seen 64% of the measured PM_{10} data were observed in the range of 0.1-40.7 µg / m³. 80% of the same data is less than 56.4 µg/m³ and 91% of the data has the highest density observed in the range 1.1-82.1 µg / m³. while 77% of the measured SO_2 data was observed in the range of 1.5-22.7 µg / m³. 80% of the same data is less than 25.1 µg / m³ and 90% of the data has the highest density in the range of -4.7-37.8 µg / m³. The results also showed Wind plays an effective role in the horizontal transport of pollutants in the atmosphere. If the wind is calm, the polluted air stays where it is, and the precipitation help collapse Pollutants in the atmosphere, Because of this feature, precipitation is described as the cleaner of the atmosphere.

Keywords*: Air pollution, Van, meteorology*

INTRODUCTION

Air pollution happens when gases, solid and liquid particles substances in the air we breathe are in a density and time that will harm living health and the earths environmental. Air pollution is one of the biggest and most important problems of humanity. Air pollution exhibits a very complex and non-linear behavior as a result of positive and negative changes in time and space, depending on the meteorology and topographic structure, in the transportation of the emissions released into the receiving environment as a result of the activity of air pollution sources. Air pollution is caused by natural causes such as forest fires and volcano eruptions, as well as growing human activities today. Today, air pollution is mostly caused by motor vehicles, industrial facilities and heating. Air quality is very important in terms of the security and sustainability of human health. Increasing worldwide industrial activities and inefficient use and waste can lead to pollution threatening human health in many parts of the world (Toros, 2000; Toros & Anbarcı, 2018; Ouyang et al., 2019; Venter et al., 2020; Dursun et al., 2021, Öztürk et al., 2021). Unal et al. (2021; Fu et al. 2020). Following the COVID-19 outbreak that started in 2019, changes in human activities and behavior necessarily led to significant reductions in air pollution within the framework of efforts to limit their exposure to the infectious virus (Dursun et al., 2021; Öztürk et al. 2021; Tunç and Taurus 2020; Kılıç et al. 2020; Bilgin and Toros 2020; Yiğiter and Toros 2020; Leg et al., 2020; Dündar et al., 2020; Kara et al., 2020).

There is no more study about air pollution of the Van city so there are more study about it to understand level, behavior and changes of air pollution city of Va. Öztürk and Bayram (2019) studied temporal and seasonal distribution of air pollutant parameters, concentrations, and the relationship of pollutant parameters with temperature in the city center of Van were discussed according to the allowed limit values and solutions for the city were given. They concluded that the topographic and geographical location of the city, the winter season is harsh, and the average temperature of the city is lower than the country average. Tekin Ö.F. (2021) evaluated the air pollutants (PM10 and SO2) in the first year of the COVID-19 in the province of Van compared to the previous year.

In this study, the 2019 air pollution analysis was made for the Van province of Turkey. In this article, the behavior, source, etc. of the pollutants are analyzed by analyzing the data that has passed the quality control process with statistical techniques. It is aimed to create a systematic structure in these matters

and thus contribute to the increase of air quality, which is extremely important for human health, to create socio-economically sustainable and safe of tomorrows.

DATA AND METHOD

Hourly PM_{10} and SO_2 parameters data for 2019 were obtained from the Ministry of Environment and Urbanization air quality monitoring stations (Figure 1). Air pollution and meteorological data are obtained from the Ministry of Environment and Urbanism of Turkey and the Turkish State Meteorological Service.

The study area is located in the eastern sites of the Lake Van region, Eastern Turkey with a population of approximately 1 million 150 thousand. The city center of Van is located at latitude 38.497 N and longitude 43.3816 E. The continental climate is dominant in the province located in the east of Turkey. Therefore, it is dry and hot in summer and cold and snowy in winter. However, Lake Van, Turkey's largest lake, makes the continental climate of the city slightly more humid(ÖZTÜRK and BAYRAM 2019)

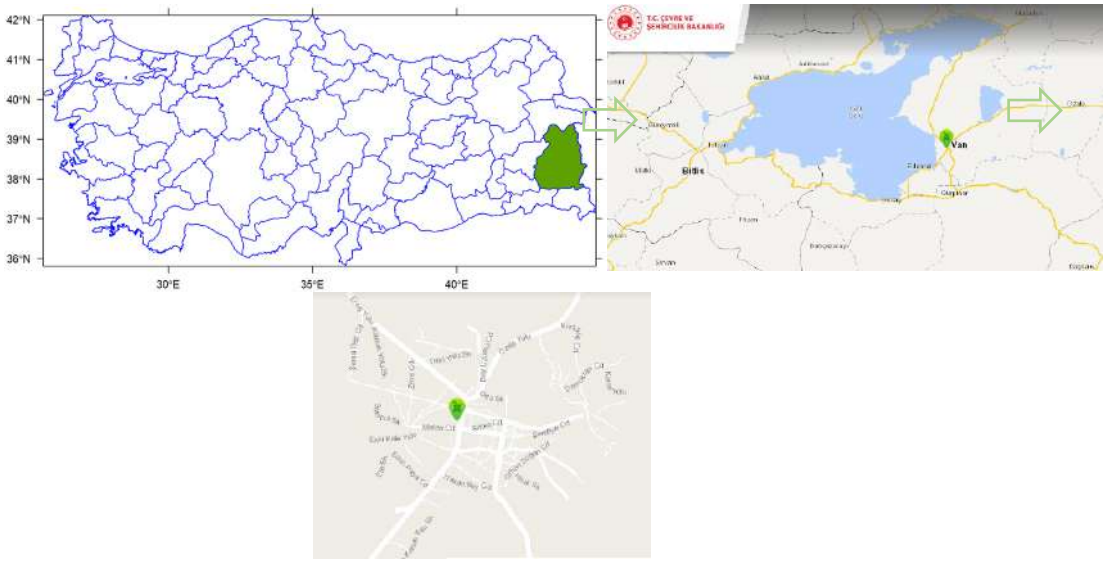

Figure 1. The location of Van on the map of Turkey

The temporal variation of each pollutant (according to density and index values), the largest, smallest, average values over time, temporal variation of meteorological data, and the relationship between meteorological data and pollutants were examined.

RESULT

It is very important in analysis to see how pollutants have changed over time. The situations where the pollution intensity increases, decreases or reaches the highest level can be observed with the help of graphs. In addition, the simultaneous increase and decrease of two different pollutant parameters is also very important in terms of determining the pollutant source.

the change parameters PM10 and SO_2 at weekdays the highest hourly average value of(78.7 µg / m - 27.5 µg / m³) at 21:00 hours respectively , and the lowest value of (24.5 µg / m³ - 10.9 µg / m³) at 06:00 hours respectively, as seen in Figure 2. while see in Figure 3 at the weekend the highest average hourly value of PM10 and SO_2 parameter (72.5 µg / m³ , 25.1 µg / m³) , and observed the lowest value of (24.8 µg / m³ , 11.4 µg / m³) at (22:00,16:00 hours) respectively.

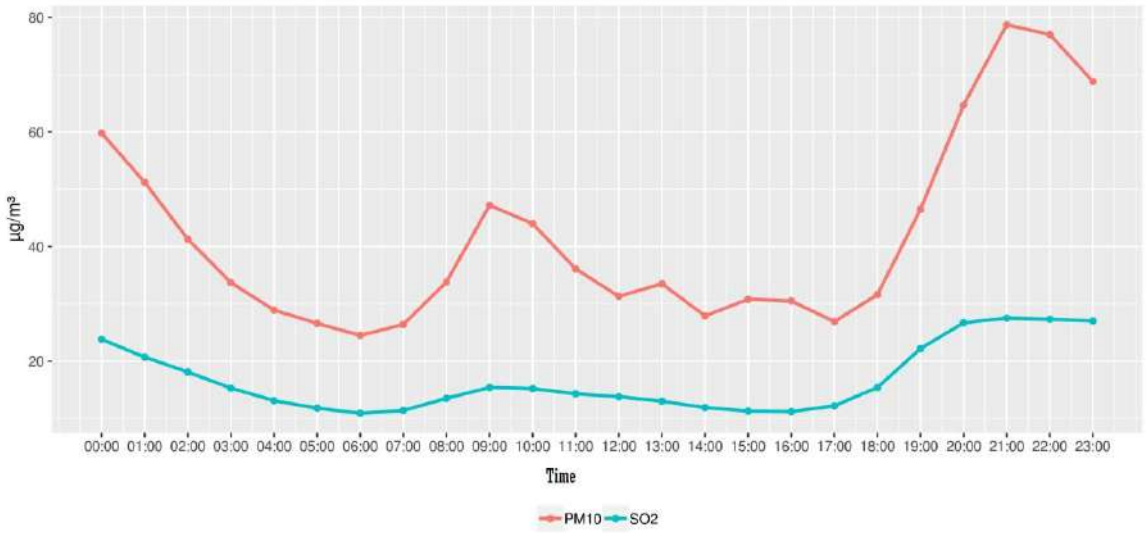

Figure 2.Time change graph of pollutants during the week.

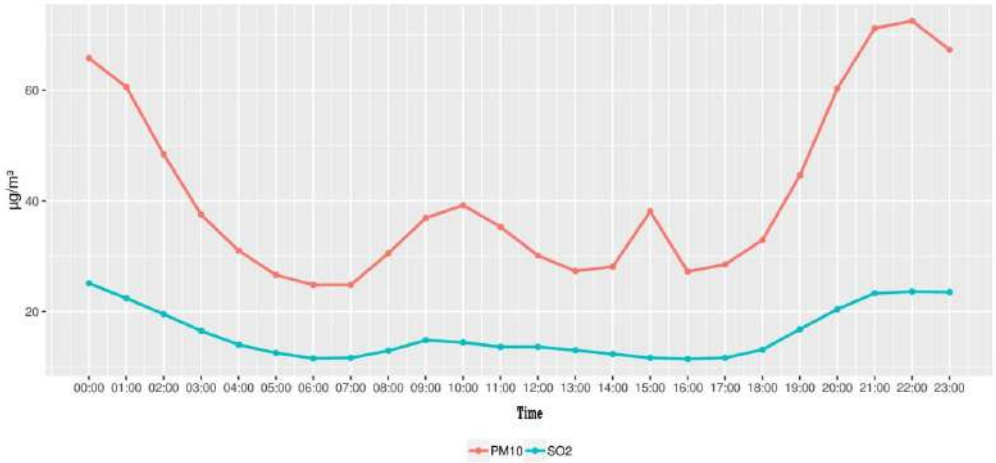

Figure 3. Time-change graph of pollutants over the weekend.

The high daily average change of pollutants PM10 and SO_2 of (146.1 µg / m - 82 µg / m³)was observed (on Tuesday, July 09 - on Thursday, February 07) respectively, but the lowest daily average of (9.4 µg / m³ -1.8 µg / m³) value was observed (on Thursday, April 18- on Tuesday, July 02) respectively as seen in Figure 4.

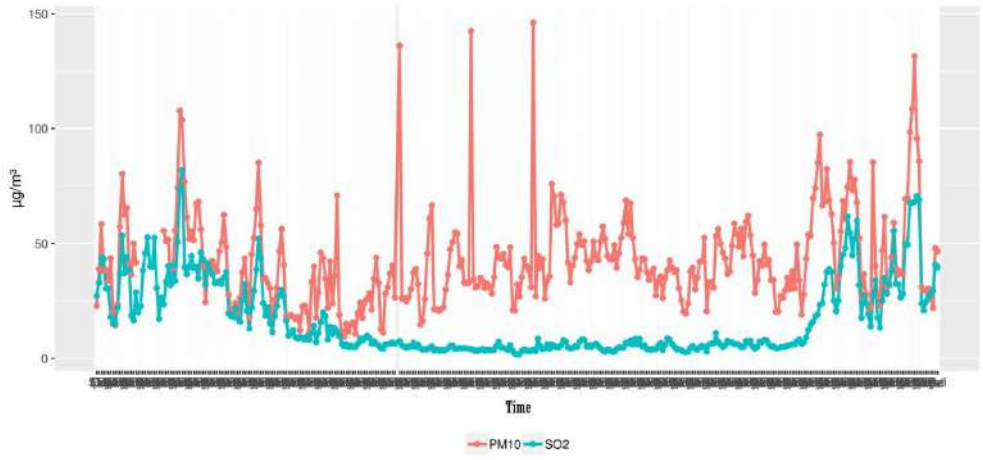

Figure 4. Daily average change graph of pollutants.

Figure 5 show 64% of the measured PM10 data were observed in the range of 0.1-40.7 µg / m³. 80% of the same data is less than 56.4 µg / m³ and 91% of the data has the highest density observed in the range 1.1-82.1 µg / m³, and also 77% of the measured SO_2 data was observed in the range of 1.5-22.7 µg / m³. 80% of the same data is less than 25.1 µg / m³ and 90% of the data has the highest density in the range of -4.7-37.8 µg / m³.

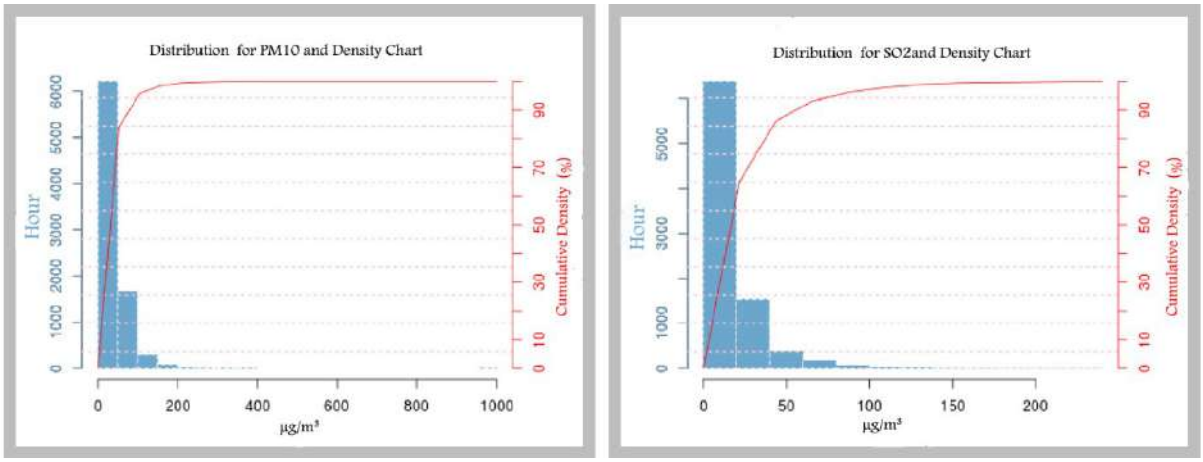

Figure 5..Histogram and density graphs of pollutants.

The average values of PM10, SO_2 parameters were measured as 41.6, 16.5 µg / m³, respectively. The extreme values corresponding to 75 percent were measured as 50.3 and 21 µg / m³, respectively show in Table 1.

Table 1. Measurement data summary information

Type	NM	Daily%	Min.	%25	Avg.	Median	%75	Max.	SD.
PM10	8697	96	0.1	20.7	41.6	32.9	50.3	1000	40.5
SO_2	8697	100	1.5	4.6	16.5	7.7	21	232.1	21.2

Table 2, shows the ranges for the air quality index applied in our country. When the PM10 measurement values were examined as a percentage, it was observed that 73% was in the GOOD class, 25% in the MIDDLE class, and 2% in the SENSITIVE class.also, SO2 measurement values are examined as a percentage, it is observed that 99% is in the GOOD class and 1% is in the MIDDLE class.

Table2. National Air Quality Index

Index	Air Quality Index	SO_2 [µg/m³]	PM10 [µg/m³]
		1 Hour Cover.	24 Hours Cover.
Good	0 – 50	0-100	0-50
Middle	51 – 100	101-250	51-100
Sensitive	101 – 150	251-500	101-260
Unhealthy	151 – 200	501-850	261-400
Bad	201 – 300	851-1100	401-520
Dangerous	301 – 500	>1101	>521

Wind plays an effective role in the horizontal transport of pollutants in the atmosphere. In the presence of wind, the pollution is moved from one place to another. If the wind is calm or slightly intense, the polluted air stays where it is. Therefore, air pollution is most intense in areas that are closed to the wind. In this case, dilution of the pollutants in the air occurs in direct proportion to the increase in wind speed. Figure 6 as show, the pollution rose graph is examined, depending on the wind direction For PM10 and SO2 pollutant parameters, the direction with the highest pollution frequency was observed as East.

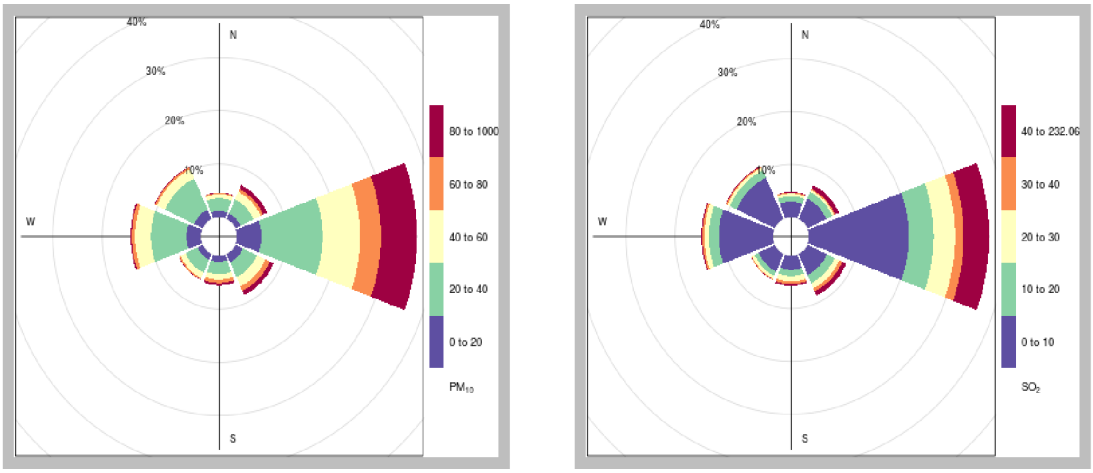

Figure 6. Pollution rose graph.

CONCLUSION

The main concluding remarks obtained from this study are summarized as follows:

- The parameters PM_{10} and SO_2 are highest on a weekday and decrease on weekend .
- The high daily average parameters PM10 and SO_2 of (146.1 µg / m - 82 µg / m^3)was (on Tuesday, July 09 - on Thursday, February 07) respectively.
- PM10 and SO_2 pollutant parameters, the direction with the highest pollution frequency was observed as East.

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