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EFFECTS OF METEOROLOGICAL PARAMETERS ON PRIMARY AIR POLLUTANTS: CASE STUDY AT DHAKA (CAMS-3, DARUS-SALAM)

Sayma Sathi*, Jobaer Ahmed Saju, Md. Asif Ahmed*, Joy Podder*, Abdullah All Noman**, Md. Emdadul Haque*** Md. Abul Kalam Azad* and Bidyut Datta*****

**European University of Bangladesh, Dhaka*
***Khulna University of Engineering &Technology, Khulna*
****International University of Business Agriculture and Technology, Dhaka*

ABSTRACT

The meteorological variables influence ambient air quality in urban areas of Bangladesh. Although Dhaka, the capital of Bangladesh, is one of the most polluted megacities in the world, limited is known about the potential effects of weather on specific air pollutants in this megacity. In this study, the correlations between meteorological variables, such as daily mean temperature (^{0}c), relative humidity (percentage), rainfall (mm), solar radiation watt/m^2, and the concentration of specific air pollutants (SO_2, CO, NOx, O_3, $PM_{2.5}$, and PM_{10}) from July 2016 to July 2018 were evaluated. The investigation of the trend in the concentration of air pollutants during the time period was another focus of this study. The correlations between air pollution concentration and temperature, relative humidity, and rainfall were demonstrated through time series analysis. This study revealed that while meteorological indicators were declining, the concentration of the main air pollutants increased. With changeable meteorological characteristics and seasonal variations, this research anticipated incremental forecasting accuracy of air pollution. When relative humidity and temperature fall, $PM_{2.5}$ and PM_{10} both increase. On the other hand, the concentration of particulate matter dropped with the increase in precipitation and solar radiation. In conjunction with a drop in temperature and relative humidity, SO_2 rises. In contrast, SO_2 levels dropped while precipitation and solar radiation increased. The concentration of NO_2 increases as temperature and relative humidity decrease. In contrast, the incremental behavior of precipitation and solar radiation leads to a decrease in NO_2 concentration. CO rises while temperature and relative humidity decrease. On the other hand, due to the rainfall and solar radiation rising, the concentration of CO dropped. Inverse connections were observed among particulate matter and temperature, precipitation, and relative humidity. These negative relationships may be attributed to increased biomass burning during low-temperature periods, the washout effect of rains, and the dry deposition effect of higher humidity.

Key words: *Particulate matter, Gaseous pollutants, CAMS, Air quality, Meteorology*

INTRODUCTION

Air pollution is the maximum disquiet for the atmosphere which has the greatest dominance on the environment as well as public health-related to lung and cardiac disorders. Bangladesh, the most populous and developing third-world nation in the world, is likewise in the process of developing. In contrast, its population limit exceeds the percentage of its territory. As a result, a significant amount of air pollution in the nation comes from several sources. According to statistics, "air pollution" kills close to 15,000 Bangladeshis annually (S. Mahmood, 2011a). According to a World Bank assessment, Bangladesh could save between $200 million and $800 million annually, or around 0.7% and 3.0 percent of its gross domestic product, if air pollution in only four of its largest cities is reduced (Islam et al., 2021). In 2001, the South Asia online forum reported that 6.5 million individuals in four major Bangladeshi cities experience hardship annually. Another 8.5 million instances, at least, were noted to have rather mild conditions that didn't call for intensive care. Instead of severe heart attacks, which may be a more likely problem among those who spend decades living in highly polluted areas, diarrhea is not the most common ailment in Bangladesh.

The World Health Organization (WHO) considers clean air to be a basic requirement of human health and well-being. It recognizes ambient air pollution as a major environmental health problem affecting everyone in developed and developing countries. Therefore, it is necessary to investigate the emission level of air pollutants and their contribution to ambient air quality from the power plant as well as the impact on human health.In 2010, estimated worldwide emissions from human activities totaled nearly 46 billion metric tons of greenhouse gases, expressed as carbon dioxide equivalents (USEPA, 2005). This represents a 35 percent increase from 1990 (USEPA, 2004). These numbers represent net emissions, which include the effects of land use and forestry. Between 1990 and 2010, global emissions of all major greenhouse gases increased net emissions of carbon dioxide increased by 42 percent, which is particularly important because carbon dioxide accounts for about three-fourths of total global emissions (USEPA, 2004). Nitrous oxide emissions increased by 9 percent while emissions of methane increased by 15 percent (USEPA, 2005). The energy production sector represents the largest source of greenhouse gas emissions (71%) worldwide followed by agriculture (13%) in 2010 (USEPA, 2005).

Air pollutants in Dhaka city have reached an alarming degree. It has been troubled with excessive air pollution where the particulate count is equal to the principal pollutant. This look investigates the awareness degree of $PM_{2.5}$ in Dhaka. There is a widespread trend of $PM_{2.5}$ with specific months in a year in Bangladesh. The maximum concentrationwas found in January while the minimum in July. Throughout the seasonal variant, it suggests that the winter season ruled the whole 12 months in terms of air pollution. It also observed that meteorological characteristics are one of the key factors to steer the concentration of $PM_{2.5}$ in Dhaka Especially, rainfall and $PM_{2.5}$ had a robust and poor relationship. Much less quantity of rainfall at some stage in winter has been the top influencing aspect in increasing PM2.5.31.9 %) in consequently in Dhaka. Meteorology plays a crucial role in the distribution of particulate matter (PM). Many studies have shown that mass concentrations in area units are influenced by varied meteorological parameters such as precipitation, temperature, wind speed, and relative wetness (Karar et al., 2006). These meteorological variables in addition have an impression on the emissions of aerosol from the bottom surface, their continuance at intervals, and thus the formation of secondary pollutants. Precipitation is one in all the reasons for low aerosol particles in monsoon season as a result of the particles washed out by rain. Wet deposition by precipitation or wet removal is one in all the foremost vital mechanisms for the removal of aerosols from the atmosphere (Budhavant et al., 2012). Air quality and natural science factors area unit closely connected through region chemical reactions and dynamic processes.

Most air pollution comes from energy use and production. Consuming hazardous chemical material and fossil fuel redemptions baneful gases and chemicals into the air is more dangerous for human life, creature life also the environment. Mass Primary air pollutants are particulate matter (PM), CO, NOx, SO_2, and O_3. PM is the most serious issue for the atmosphere. Gaseous pollution is lesser in Bangladesh than particulate matter pollution (Begum & Biswas, 2008).SO_2, NO_2, and CO are directly disposed of into the air. Ozone also occurs through a chemical reaction in the atmosphere as gasoline vapors. Many research reports that meteorological parameters and ambient air quality are potential influences in urban areas. Meteorological parameters such as rainfall, relative humidity, and temperature all play a vital role in equilibrium pollutant levels for a given rate of pollutant emersion (Kayes et al., 2019). In Bangladesh, there are four different seasons: from December to February is called as winter, from March to May is called as Pre-Monsoon, monsoon starts from June to September, and post-monsoon is from October to November (Begum & Biswas, 2008). During winter, cold wind blows, dry soil conditions, nominal rainfall, and relative humidity prevails. In pre-monsoon rainfall is moderately high, and it increases relative humidity. During monsoon, high relative humidity prevails and moist air conditions occur. In the monsoon, the highest amount of rainfall remains. In the post-monsoon, precipitations start to decrease also as the relative humidity (Azad & Kitada, 1998; Manju et al., 2018; Orioli et al., 2018). The principal sources of outdoor air pollution in urban areas of Bangladesh are the industrial and transportation sectors. Under the Clean Air and Sustainable Environment (CASE) project, the Department of Environment (DoE) monitors real-time $PM_{2.5}$ (24hr), and PM_{10} (24hr). SO_2 (24hr), NO_2 (24hr), CO(1hr), CO (8hr), O_3(1hr), and O_3 (8hr) as well as ambient temperature, rainfall, relative humidity, through 11 continuous Air Monitoring Stations (CAMS) throughout Bangladesh (CASE, 2017). The third CAMS is situated at the Mass Communication Institute in the Darus Salam area, Dhaka. This location is distinguished by heavy traffic; a large number of vehicles from the northern part of the country. Major brick kiln clusters are also near the monitoring location. Air quality and Meteorological data of CAMS-3 (Darus Salam) for the year 2016-2018 were collected and this data was utilized for the analysis of this study. The aim of this study was

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to assess the temporal and seasonal variation of criteria air pollutants with meteorological parameters in Dhaka city (CAMS-3).

METHODOLOGY

Study Area

As part of the Clean Air and Sustainable Environment (CASE) project, the Department of Environment (DoE) monitors PM_{10} (24h), $PM_{2.5}$ (24h), a NO_2, CO, SO_2, and O_3, and the environment in real-time temperature (1 h), precipitation (1 h), relative Humidity (1 h) through 11 continuous air monitoring Stations (CAMS) throughout Bangladesh. We collected air quality and meteorology Data from CAMS-3 (Darus Salam), Dhaka, with a longitude of 23˚46'42.35" and latitude of 90˚21'44.54") for the year 2016-2018 However, we used data from CAMS-3 (Darus Salam, Dhaka) for assessing the variation in concentration of six criteria air pollutants. Figure 1 shows the geographic location (latitude and longitude) of CAMS3, Dhaka.

Variation in Pollutants Concentrations

Many statistical methods have been used to analyze the air pollutants in recent years. Time series analysis is being used as a useful tool for better understanding the cause, effect relationship of air pollutants. In this study, variation in daily mass concentration of air pollutants and meteorological parameters was observed through time series analysis. Daily variation showed the peak daily values and as well as the lowest value of a certain pollutant in a specific location. The increasing and decreasing trends of pollutants concentration was made to understand from the time series analysis. Time-series model usually asserts a relationship in between a certain number of temporal sequences or time series. The simple regression model of time series analysis is given by equation 1. Here, y(t) = {yt; t = 0, ±1, ±2,...} is an order, indexed by the time symbol t, which is a conjunction of an observable order x(t) = {xt} and an unobservable order ε(t) = {εt} of independent and identical delivered random variables.

$$y(t) = x(t)\beta + \varepsilon(t) \dots\dots\dots\dots\dots\dots (1)$$

Spatial variation of mass concentration was also observed. The evaluation methods incorporated in this study are similar to several studies (Saju et al., 2022).

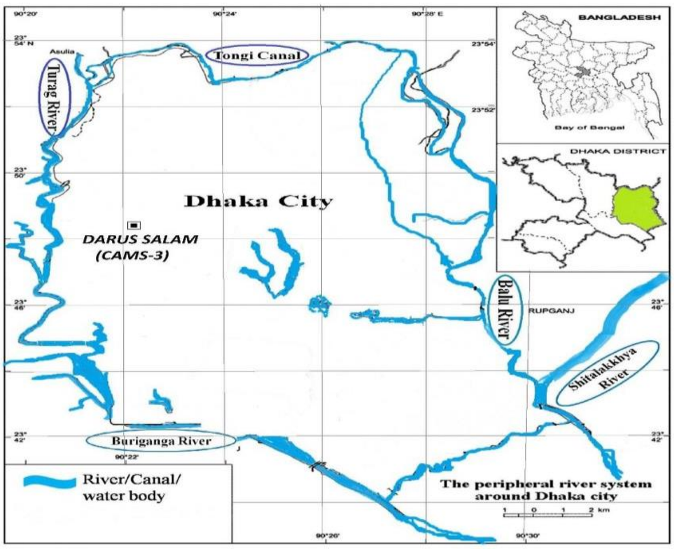


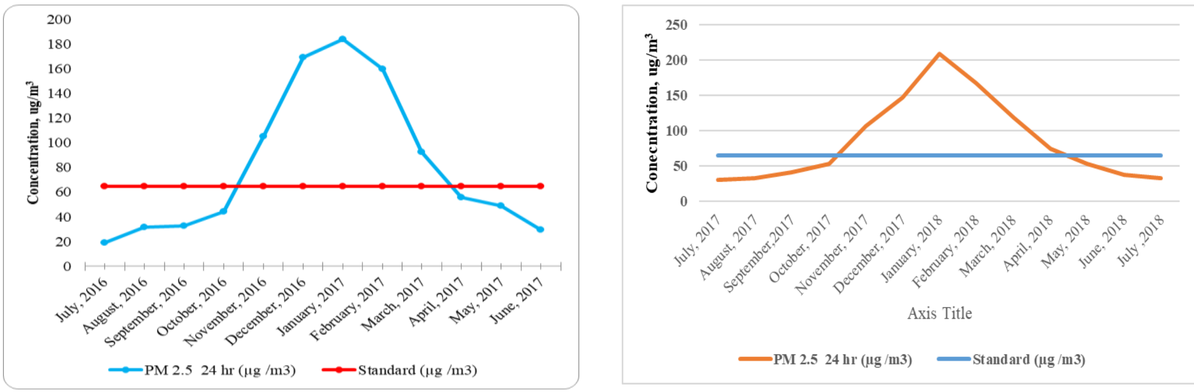
Figure 1 Geographic location of CAMS-3, Darus Salam, Dhaka

RESULTS AND DISCUSSION

Relation Between Particulate Matter and Meteorological Parameters

Figure 2(a) shows the concentration of $PM_{2.5}$ from 2016 to 2017. $PM_{2.5}$ standard value is 65 µg/m^3. In July 2016 $PM_{2.5}$ concentration started at 19.2 ug/m^3 and gradually increased up to January 2017 at 183.9 µg/m^3. From February 2017 $PM_{2.5}$ started to fluctuate then the concentration level was 29.9 µg/m^3 in June 2017. Figure 2(b) displays the amount of $PM_{2.5}$ µg/m^3 from 2017 to 2018. In 2017 $PM_{2.5}$

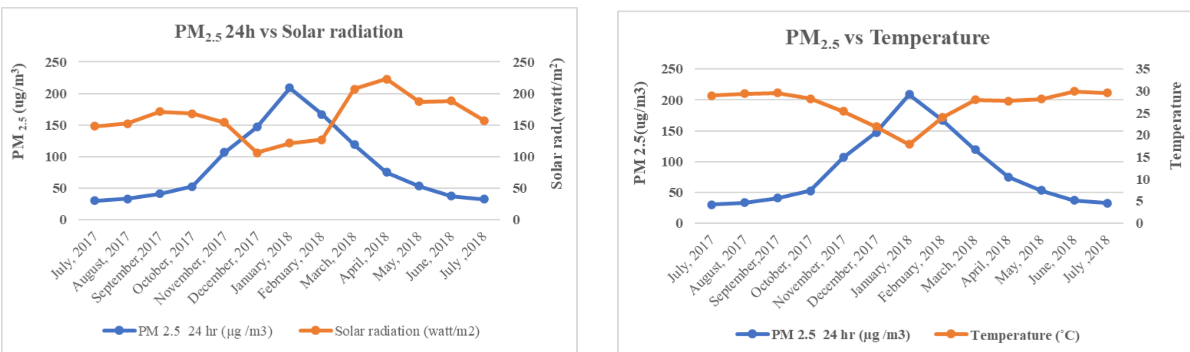
µg/m³ concentration starts from 30.2 µg/m³ and gradually increased up to January 2018 at 209 µg/m³. From February 2018 $PM_{2.5}$ µg/m³ fluctuated slightly and the concentration level was 32.6 µg/m³.



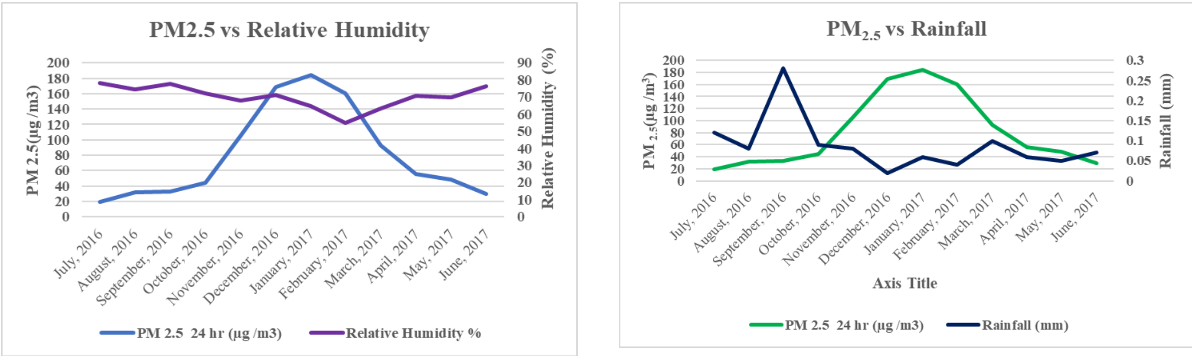
(a) (b)

Figure 2 (a) $PM_{2.5}$-(24h) µg/m³ (July 2016- June 2017) (b) $PM_{2.5}$ (24hr) from July 2017- July 2018

Figure 3 (a) presents the relation between $PM_{2.5}$ and solar radiation. It can be observed from the figure that $PM_{2.5}$ and solar radiation carried a contratory relationship. When solar radiation was decreased $PM_{2.5}$ increased, likewise when solar radiation was increased $PM_{2.5}$ decreased. The highest concentration of $PM_{2.5}$ was observed in January 2018 at 209 µg/m³ while the solar radiation was 121 watt/m². The lowest concentration of $PM_{2.5}$ was found in July 2017 at 30.2 µg/m³ where the solar radiation was 118 watt/m ². The minimum solar radiation found in December 2017 at 106 watt/m ² whereas $PM_{2.5}$ was 147 µg/m³. Figure 3(b) presents the relation between $PM_{2.5}$ and temperature. It can be observed from the figure that $PM_{2.5}$ and temperature carried a reverse relationship. When temperature was decreased $PM_{2.5}$ increased, similarly when temperature was increased $PM_{2.5}$ decreased. The highest concentration of $PM_{2.5}$ was observed in January 2018 at 209 µg/m³ while the temperature was 17.9⁰C. The lowest concentration of $PM_{2.5}$ was found in July 2017 at 30.2 µg/m³ where the temperature was 29⁰C. Figure 3 (c) illustrates the comparison between $PM_{2.5}$ and relative humidity. In this graph, relative humidity concentration was same almost over the year from 2017 to 2018. In July 2017 relative humidity concentration was 79.3% and it fell slightly in March 2017 to 57.4% and reached again at 78.4% in July 2018. On the other hand, $PM_{2.5}$ was picked as the highest amount of concentration at 209 µg/m³ in January 2018 then it dropped to a low of 32.6 µg/m³ in July 2018. Figure 3 (d) illustrates the differences between $PM_{2.5}$ and rainfall. It has been a diverse scenario shown between $PM_{2.5}$ and the rainfall. This year rainfall was much minimal. The concentration of rainfall started at 0.06 mm in July 2017 when $PM_{2.5}$ was 30.2 µg/m³. $PM_{2.5}$ reached the top in January 2018 at 209 µg/m³ while rainfall has the same concentration at 0.06 mm. In May 2018 rainfall reached 2.2 mm but again fell in July 2018 to 0.06 mm where $PM_{2.5}$ was 32.6 µg/m³.



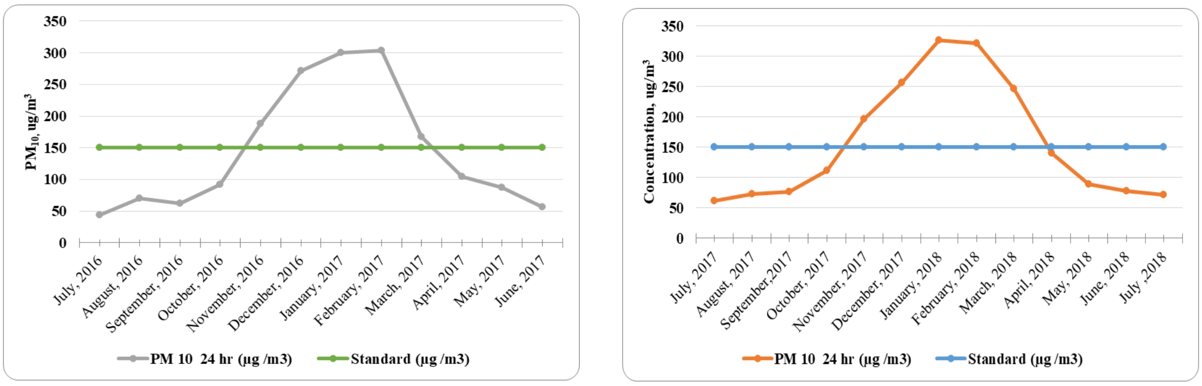
(a) (b)



(c) (d)

Figure 3 (a) $PM_{2.5}$ vs Solar Radiation (July 2017 - July 2018); (b) $PM_{2.5}$ vs Temperature from July 2017 to July 2018; (c) $PM_{2.5}$ vs Relative Humidity (July 2016-June 2017); (d) $PM_{2.5}$ vs Rainfall (July 2016-June 2017)

Figure 4 (a) shows the amount of PM_{10} from 2016 to 2017 where PM_{10} standard value is 150 µg/m³. In 2016 PM_{10} concentration started from 44.3 µg/m³ and it gradually increased up to February 2017 at 303 µg/m³. From March 2017 PM_{10} fluctuated slightly and the concentration level was 56.6 µg/m³. Figure 4 (b) shows the amount of PM_{10} from 2017 to 2018. In 2017, PM_{10} started to decrease up to 61.1 µg/m³ and will gradually increase to 327 µg/m³ by January 2018. In February 2018, PM_{10} fluctuated slightly and the concentration level was 71.4 µg/m³ in July 2018.



(a) (b)

Figure 4 (a) PM_{10} (24h) µg/m³ (July 2016- June 2017) (b) PM_{10} (µg/m³) from July 2017 to July 2018

Figure 5 (a) provides the relation between PM_{10} and solar radiation. It may be found from the discernment that PM_{10} and solar radiation carried an opposite relationship. When solar radiation become reduced PM_{10} is elevated, similarly whilst solar radiation becomes elevated PM_{10} was reduced. The maximum concentration of PM_{10} become found in February 2017 at 303 µg/m³ at the same time as the solar radiation become 143 watt/m ². The lowest attention of PM_{10} found in July 2016 at 44.3 µg/m³ in which the solar. Figure 5 (b) presents the relation between PM_{10} and temperature. It can be observed from the figure that PM_{10} and temperature carried a reverse relationship. When temperature was decreased, PM_{10} increased, similarly when temperature was increased, PM_{10} decreased. The highest concentration of PM_{10} was observed in February 2017 at 303 µg/m³ while the temperature was 23.9⁰C. The lowest concentration of PM_{10} was found in July 2016 at 29.1 µg/m³ where the temperature was 44.3⁰C. Figure 5 (c) illustrates the comparison between PM_{10} and relative humidity. In this graph, in July 2017, the relative humidity concentration was 79.3%, while the PM_{10} was 61 µg/m³. PM_{10} showed the highest concentration with 327 µg/m³ in February 2018, while the relative humidity decreased slightly to 69.3%. Figure 5 (d) illustrates the differences between PM_{10} and precipitation. It was a diverse storyline shown in PM_{10} and the rainfall. The precipitation concentration started at 0.06 mm in July 2017 when the PM_{10} was recorded as 61.1 µg/m³. PM_{10}

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peaked at 327 µg/m³ in February 2018, while precipitation has the same concentration at 0.06 mm. In May 2018, precipitation reached 2.2 mm but fell to 0.06 mm in July 2018 when PM_{10} was 71.4 µg/m³.

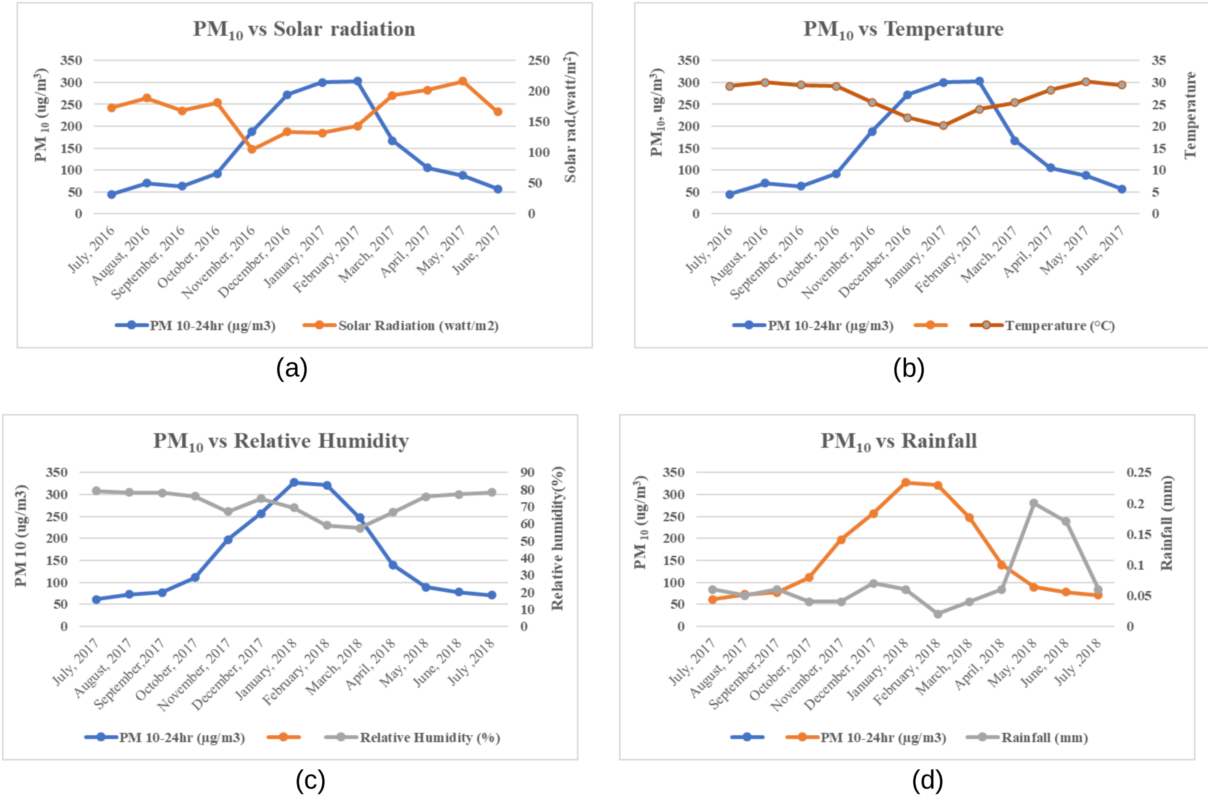


Figure 5 (a) PM_{10} vs Solar Radiation (July 2016 - June 2017); (b) PM_{10} vs Temperature (July 2016- June 2017); (c) PM_{10} vs Relative Humidity (July 2017- July 2018); (d) PM_{10} vs Rainfall (July 2017- July 2018)

Relation Between Gaseous Pollutants and Meteorological Parameters

Figure 6(a) illustrates the concentration of SO_2 from 2016 to 2017. The standard value of SO_2 is 140 ppb. In 2016, SO_2 started at 1 ppb and will gradually increase to 31.62 ppb in February 2017. In March 2017, SO_2 fluctuated slightly and the concentration level was 2 ppb in June 2017. Figure 6(b) shows the concentration of SO_2 from 2017 to 2018. In 2017, SO_2 started at 5 ppb and gradually increased to highest 24 ppb in December 2017. In January 2018, SO_2 fluctuated slightly at 14.7ppb and jumped again in February at 20.7 ppb. Then the concentration level was fell again 9.11 ppb in July 2018.

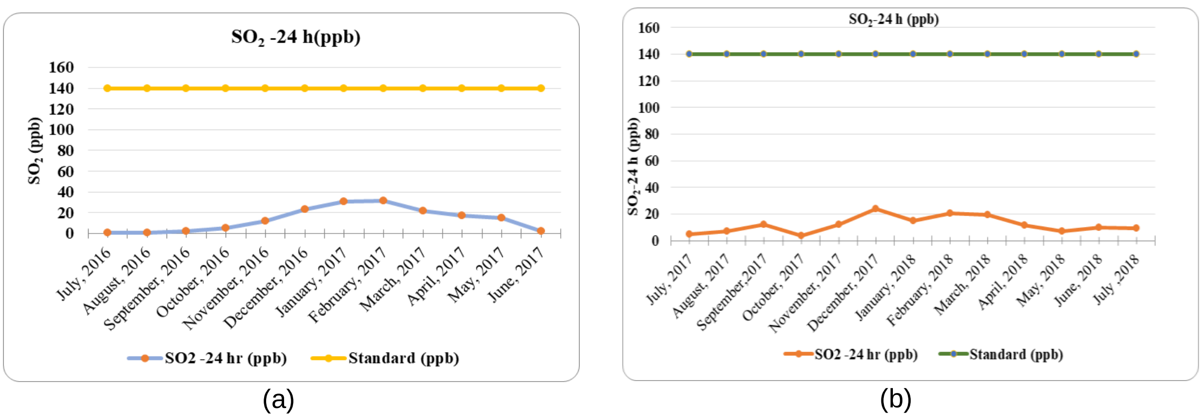
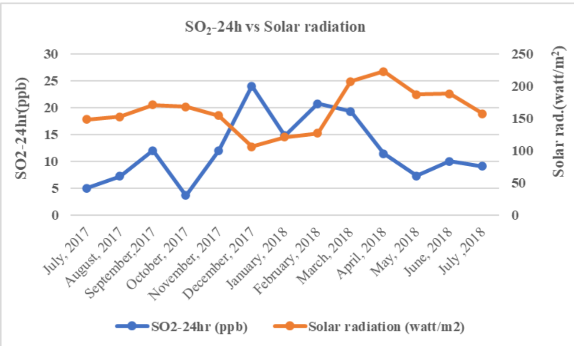


Figure 6 (a) SO_2 (24h) ppb (July 2016- June 2017) (b) SO_2 (ppb) from July 2017 to July 2018

Figure 7 (a) displays the relationship between SO_2 and solar radiation. It can be deduced from the observation that SO_2 and solar radiation had an opposite relationship. The maximum concentration of SO_2 was found in December 2017 as 24 ppb at the same time the solar radiation became 106 watt/m^2. The lowest attention value of SO_2 was found in October 2017 at 3.7 ppb, with solar radiation becoming 168 watt /m^2. Figure 7 (b) shows the relationship between SO_2 and temperature. The figure shows that SO_2 and temperature had an inverse relationship. When the temperature was lowered, the SO_2 increased. Accordingly, when the temperature was raised, SO_2 decreased. The highest concentration of SO_2 was observed in January 2017 with 31.2 ppb and temperature was 23.9^{o}C. The lowest concentration of SO_2 was found in July 2016 at 1 ppb at a temperature of 29.1°C. Figure 7 (c) illustrates the comparison between SO_2 and relative humidity. In this graph, in July 2016, the relative humidity concentration was 78%, while the SO_2 was 1 ppb. SO_2 was highest with concentration of 31.2 ppb in January 2017, while the relative humidity was 55.1%. In June 2017 relative humidity was highest at 76.2% on the other hand SO_2 was minimum at 2 ppb. Figure 7 (d) illustrates the variations between SO_2 and rainfall. There have been numerous eventualities proven in SO_2 and rainfall. This year, rainfall was totally minimum over the whole year. The maximum concentration of SO_2 become highest in December 2017 at 24 ppb even as rainfall become 0.07 mm. On the other hand, rainfall concentration was maximum in June 2018 at 0.17 mm while SO_2 was at 10 ppb.



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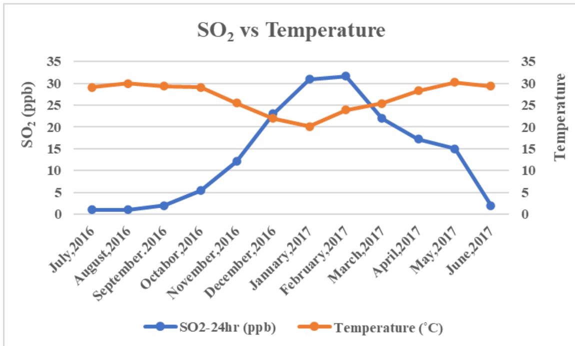

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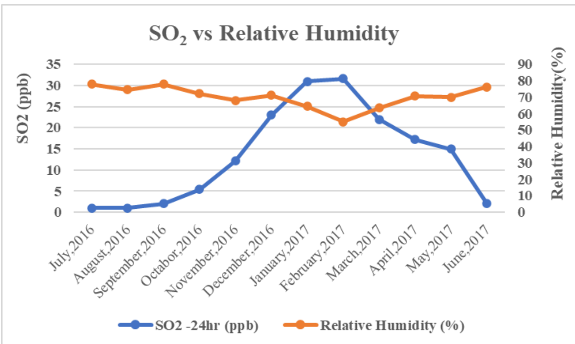

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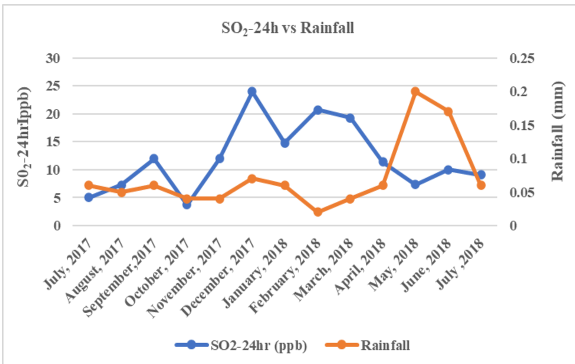

(d)

Figure 7 (a) SO_2 vs Solar Radiation (July 2017 -July 2018); (b) SO_2 vs Temperature (July 2016 -June 2017); (c) SO_2 vs Relative Humidity (July 2016 - June 2017); (d) SO_2 vs Rainfall (July 2017 -July 2018)

Figure 8 (a) shows the concentration of NO_2 from July 2016 to June 2017. The standard concentration of NO_2 is 53 ppb. In 2016, NO_2 started at 13 ppb in July 2016 and gradually increased to the highest at 81.5 ppb in November 2016, and dropped to in July 2017 at 12.6 ppb. Figure 8 (b) presents the amount of NO_2 ppb from July 2017 to July 2018. In July 2017, NO_2 started at 17.8 ppb and gradually increased to the highest at 68 ppb in January 2018. After that, NO_2 slightly dropped in February 2018 at 53.7 ppb and reached high again at 63.5 ppb in March 2018.

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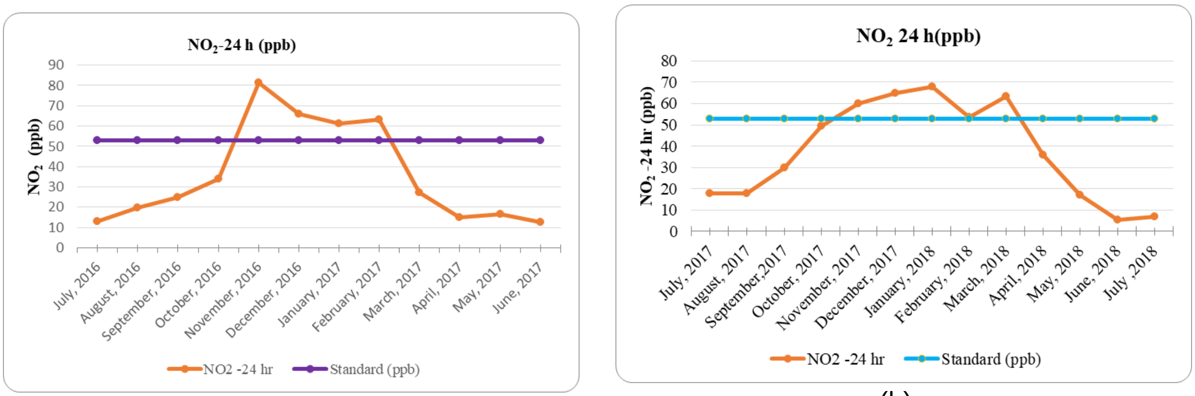
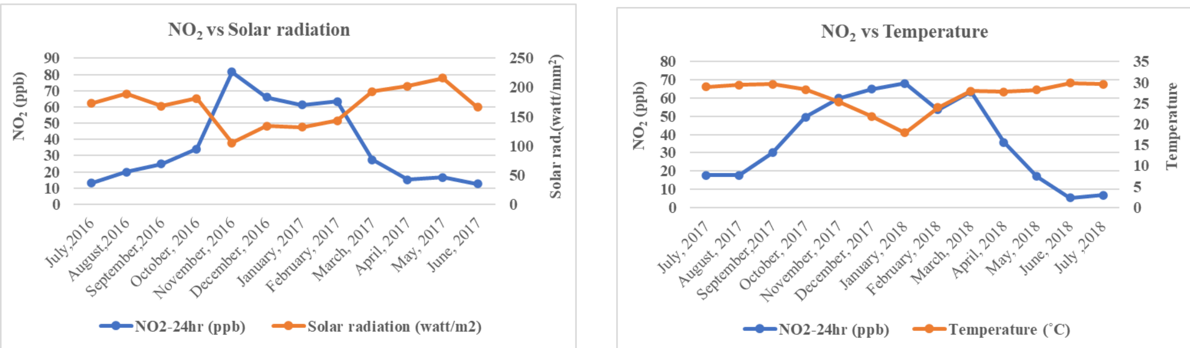


(a) (b)

Figure 8 (a) NO_2 (24h) ppb (July 2016- June 2017) (b) NO_2 (ppb) from July 2017 to July 2018

Figure 9 (a) illustrates the relationship between NO_2 and solar radiation. It can be deduced from the observation that NO_2 and solar radiation had an opposite relationship. When solar radiation was reduced, NO_2 was increased. Similarly, while solar radiation was increased, NO_2 was decreased. The maximum attention of NO_2 was found in November 2016 at 81.5 ppb at the same time as the solar radiation became 105 watt /m ^{2}. The lowest attention value of NO_2 was found in July 2017 at 12.6 ppb, with solar radiation becoming 166 watt /m ^{2}. Figure 9 (b) shows the relationship between NO_2 and temperature. The figure shows that NO_2 and temperature had an inverse relationship. In July 2017 NO_2 starts from 17.8 ppb while temperature was 29°c. The highest concentration of NO_2 was observed in January 2018 at 68 ppb and the temperature was 17.9°c. The lowest concentration of NO_2 was found in June 2018 at 5.34 ppb whereas the highest temperature was at 29.9°C. Figure 9 (c) indicates the relation between NO_2 and relative humidity. It can be represented from the graph that NO_2 changed to 34.1 ppb in October 2016 however fairly reached a maximum concentration in November 2016 at 81.5 ppb at the identical time relative humidity became 68%. The lowest value of NO_2 was changed in June 2017 aa 12.6 ppb, with relative humidity turning 73.3%. Figure 9(d) illustrates the variations among NO_2 and rainfall. There have been numerous eventualities proven in NO_2 and the rainfall. The maximum concentration of NO_2 was highest in January 2018 at 68 ppb even as rainfall becomes 0.06 mm. On the other hand, rainfall concentration was maximum in June 2018 at 0.2 mm while NO_2 was at 17 ppb.



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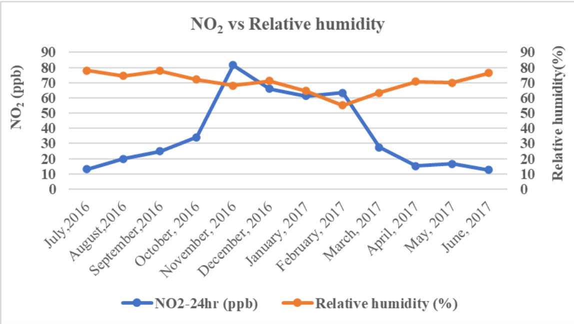

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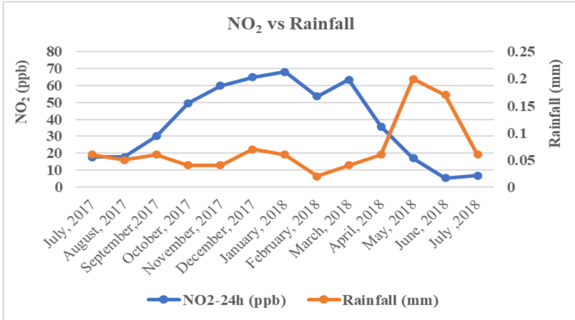
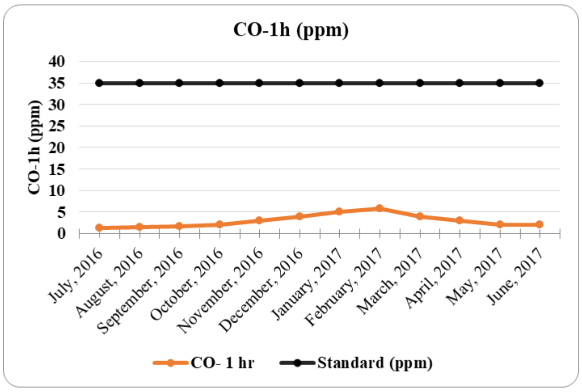


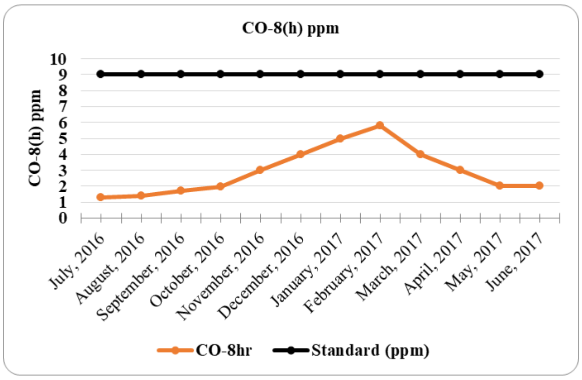
(d)

Figure 9 (a) NO_2 vs Solar Radiation (July 2016 -June 2017); (b) NO_2 vs Temperature (July 2017 -July 2018); (c) NO_2 vs Relative Humidity (July 2016 - June 2017); (d) NO_2 vs Rainfall (July 2017 -July 2018)

Figure 10 (a) shows the amount of CO from July 2016 to June 2017. The hourly standard value of CO is 35 ppm. In July 2016, CO started at 1.31 ppm and gradually increased to the highest at 5.83 ppm in February 2017. Then CO dropped to the lowest in June 2017 at 2 ppm. Figure 10 (b) shows the amount of CO-8 h from July 2016 to June 2017. The standard value of CO concentration is 9 ppm. In July 2016, CO started at 1.31 ppm and gradually increased to the highest at 5.82 ppm in February 2017.



(a)



(b)

Figure 10 (a) CO(1h) ppm(July 2016- June 2017) (b) CO-8h (ppm) from July 2016 to July 2017

Changes of CO and solar radiation are related as shown in Figure 11. CO and solar radiation had an opposed relation. CO declined when solar radiation was raised. When the solar radiation increased to 143 watt/ m^2 in February 2017, the maximum concentration of CO was found as 5.82 ppm. In July 2016, when solar radiation reached 173 watt/m^2, the lowest attention CO value of 1 ppm was observed. Temperature and CO ppm are also related as seen in Figure 11(b). The figure shows a reversal of the CO-Temperature relationship. CO increased with a drop in temperature whereas CO decreased with a rise in temperature. The lowest relative humidity was 0.55 ppm in July 2017, while the temperature was 29°C.The highest temperature recorded was 29.6°C in September 2017 with 0.92 ppm of relative CO. In January 2018, the CO concentration peaked at 4 ppm and the temperature was 17.9°c. Figure 11 (c) illustrates the comparison between CO and relative humidity. This graph shown a contrary relationship among CO and relative humidity. In July 2016, the relative humidity concentration was highest 78%, while the CO was lowest 1.31 ppm. CO was chosen as the highest concentration with 5.82 ppm in February 2017, while the relative humidity was 55.1%. Figure 11 (d) illustrates the variations between CO and rainfall. Rainfall concentration was maximum in May 2018 at 0.2 mm while CO was at 2.65 ppm. In July 2018 CO was 3.45 ppm while rainfall was 0.06 mm.

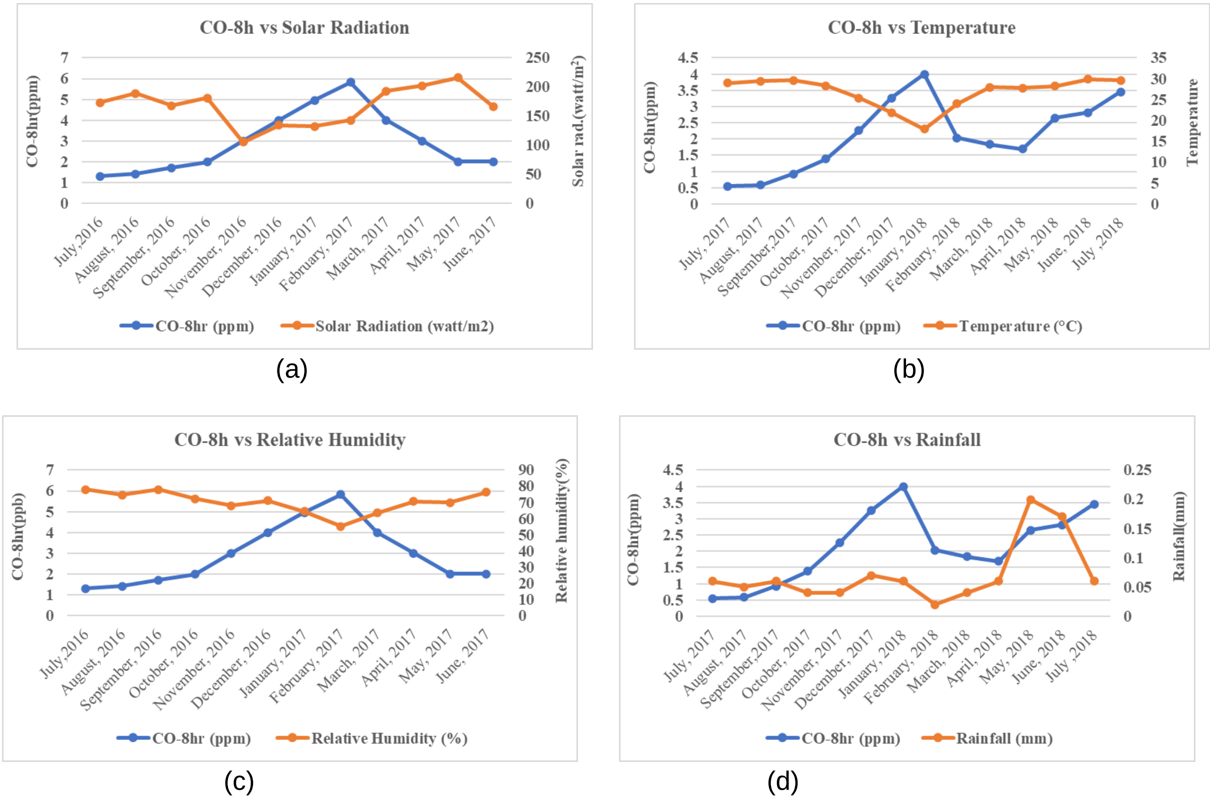


Figure 11 (a) CO-8 h ppm vs Solar Radiation (July 2016 - June 2017); (b) CO vs Temperature (July 2017 -July 2018); (c) CO-8 h ppm vs Relative Humidity (July 2016-June 2017); (d)CO-8 h ppm vs Rainfall (July 2017-July 2018)

CONCLUSIONS

Temperature and relative humidity are two meteorological factors that regulate the amount of particulate matter (PM) in the air in the Continuous Air Monitoring Station (CAMS) at Darus Salam, Dhaka. Inverse connections have been observed between PM and temperature, precipitation, and relative humidity. These negative relationships may be attributed to increased biomass burning during low-temperature periods, the washout effect of rains, and the dry deposition effect of higher humidity. Additionally, it was found that dry deposition and the scavenging effect work better to move coarser particles (PM_{10}) than finer particles ($PM_{2.5}$). The specific findings are enlisted below:

- When relative humidity and temperature fall, $PM_{2.5}$ and PM_{10} both rises, on the other hand, particle matter dropped with the increase in precipitation and solar radiation.
- In conjunction with a drop in temperature and relative humidity, SO_2 rises. Contrarily, SO_2 levels dropped while precipitation and solar radiation rise.
- NO_2 increases as temperature and relative humidity decrease. In contrast, the incremental behavior of precipitation and solar radiation leads to a decrease in NO_2 concentration.
- CO rises while decreasing values of temperature and relative humidity. On the other hand, due to the rainfall and solar radiation rising, the CO content dropped.

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