A STUDY OF DIFFERENT POLLUTANTS PRESENT IN THE AIR

PROJECT BY : PARVEZ KHAN

ABSTRACT:

Air Pollution is a major threat to today's growing world. This is usually due to the pollutant released into the air through many human activities. Air Quality is deteriorated day by day. Pollutants mainly responsible for degrading air quality are carbon monoxide(CO),sulfur dioxide(SO_2),nitrogen dioxide(NO_2) and particulate matter(PM_{10}, $PM_{2.5}$).

Time Series Analysis would be a good way out to analyse /study the trend of Air Quality time series data. we will also fit autoregressive model which is useful for forecasting.

Time Series Analysis on air quality dataset is important because it tells how clean or polluted the air is ,gives an idea what the future situation can be and what associated heath effects might be concern, especially for ground-level ozone and particle pollution.

PROJECT SUMMARY:

The project revolves around analyzing the daily data of different pollutants in the air of Anand Vihar, Delhi with respect to time. Its starts with preparing the data for visualization and goes on identifying the trend and fitting mathematical function to each parameter. And finally fitting an Autoregression process to the Air Quality Data.

OBJECTIVES OF THE PROJECT:

1. DATA PREPARATION.

2. DATA VISUALISATION

3. TREND ANALYSIS

4. BUILDING A TIME SERIES MODEL

DATASET:

The data is the daily measure of different pollutants (like carbon monoxide(CO), sulfur dioxide(SO_2), nitrogen dioxide(NO_2), particulate matter etc.) in the air .It is the data of Anand Vihar, Delhi .The data is collected from Central Pollution Control Board website. The data spanned from 01/01/2020 to 30/04/2023

DATASET DETAILS:

Description of columns in the file:

1. Date - The day when the measurement is taken.
2. Prescribed Standards – The standard range of each pollutants.
3. PM2.5 (Particulate Matter 2.5) – Microscopic matter suspended In air less then 2.5 micro meter.
4. PM10 (Particulate Matter 10) – Microscopic matter suspended In air less then 10 micro meter.
5. SO2 – Sulphur Dioxide, a pollutants in its measuring unit.
6. CO – Carbon Monoxide, a pollutants in its measuring unit.
7. NH3 – Ammonia gas, a pollutants in its measuring unit.
8. NO & NO2 – Nitrogen Oxide & Dioxide, a pollutants in its Measuring unit.
9. Ozone – (formula O3) , a pollutants in its measuring unit.

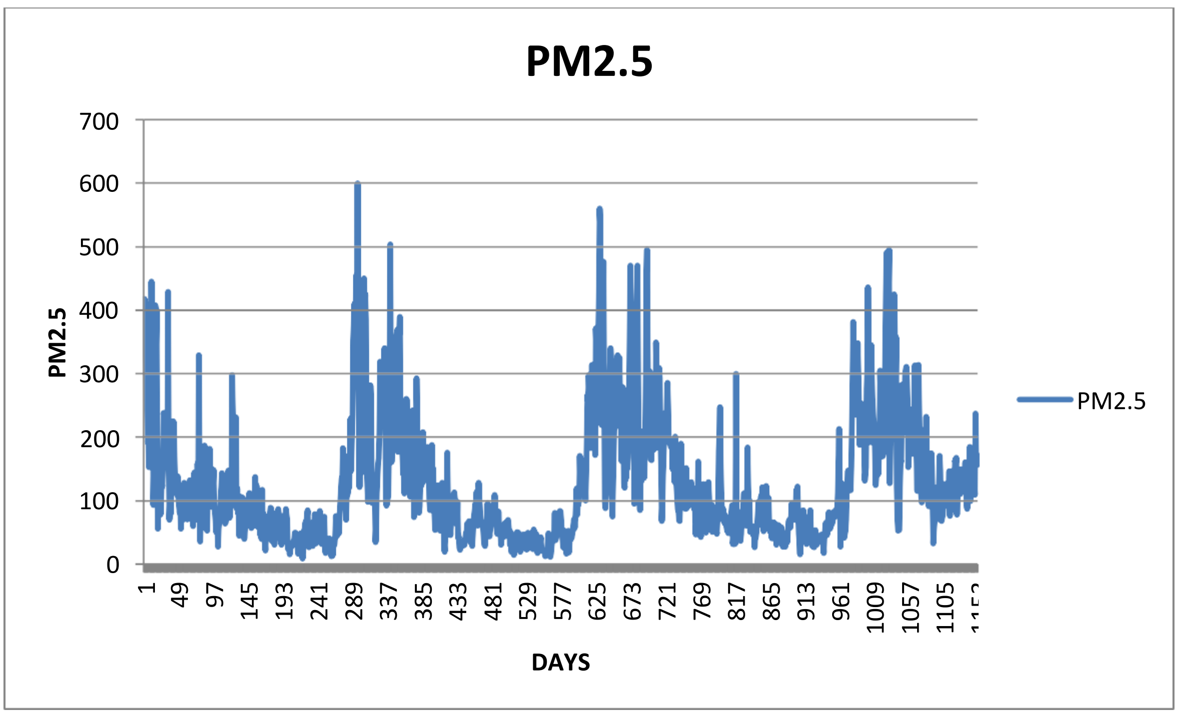
DATA VISUALISATION:

Data Visualisation plays an important in Time series Analysis. It gives a preliminary idea about the dataset i.e. how the parameter is changing with time. The best graph to represent a time series data is line diagram.

LINE DIAGRAM

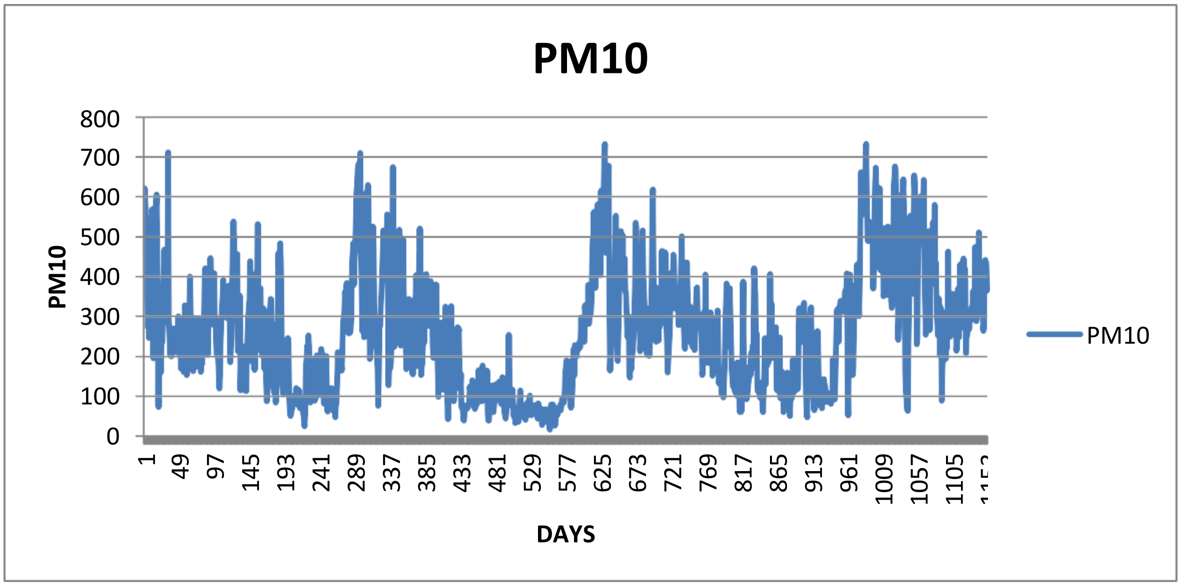
When the data vary over time we take recourse to line diagram. In simple line diagram, we plot each pair of values of (t,y), "y" representing the time series at the time point t in the "t-y" plane.

LINE DIAGRAM OF PM2.5:



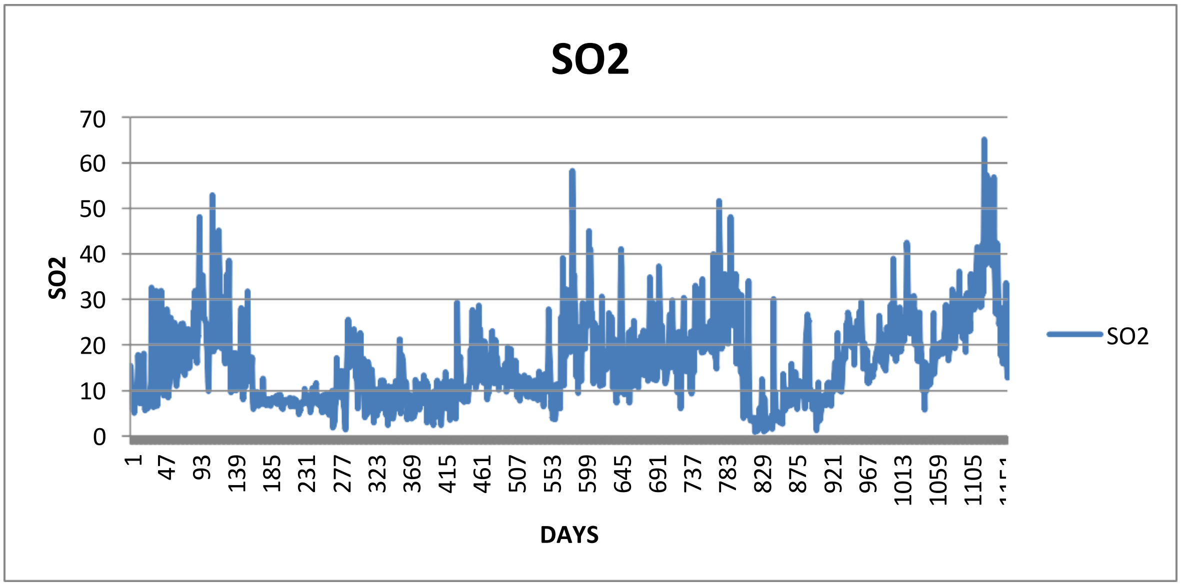
INTERPRETATION: The variations in the time series data of PM2.5 are due to rhythmic forces and tends to repeat over a time period of around 12 months. so there is a seasonal variation. The amount of PM2.5 in the air reach its peak in the month of October-November(in the start of winter) and the gradually declines. The level of PM2.5 in the air is very high compare to its prescribed standards(0-60).

LINE DIAGRAM OF PM10:



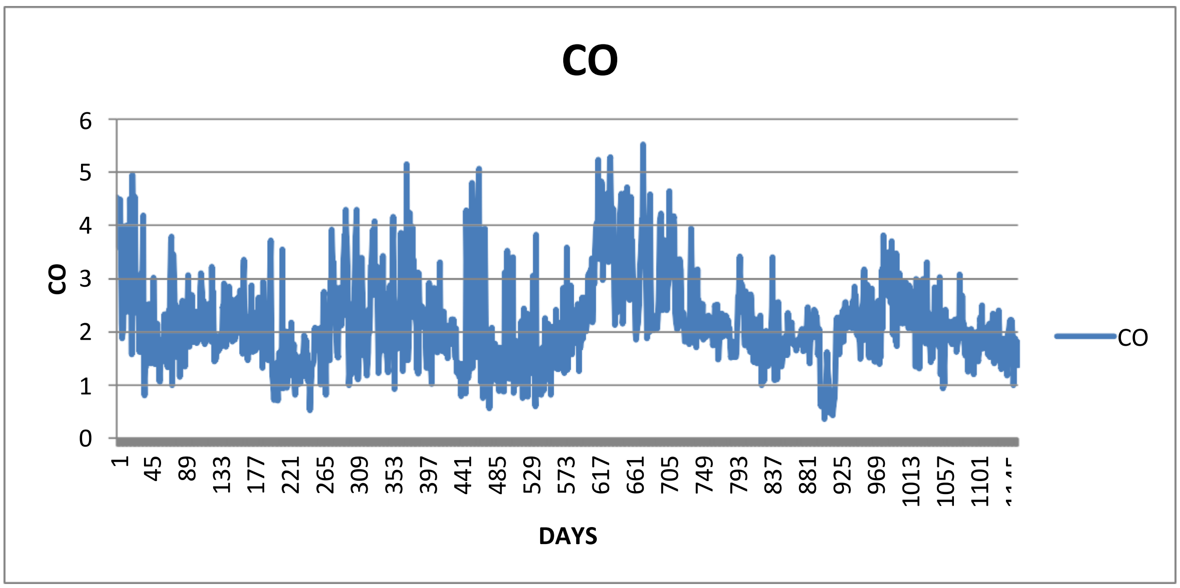
INTERPRETATION: The variations in the time series data of PM10 are due to rhythmic forces and tends to repeat over a time period of around 12 months. so there is a seasonal variation. The amount of PM10 in the air reach its peak in the month of October-November(in the start of winter) and the gradually declines. The level of PM10 in the air is very high compare to its prescribed standards(0-100).

LINE DIAGRAM OF SO2:



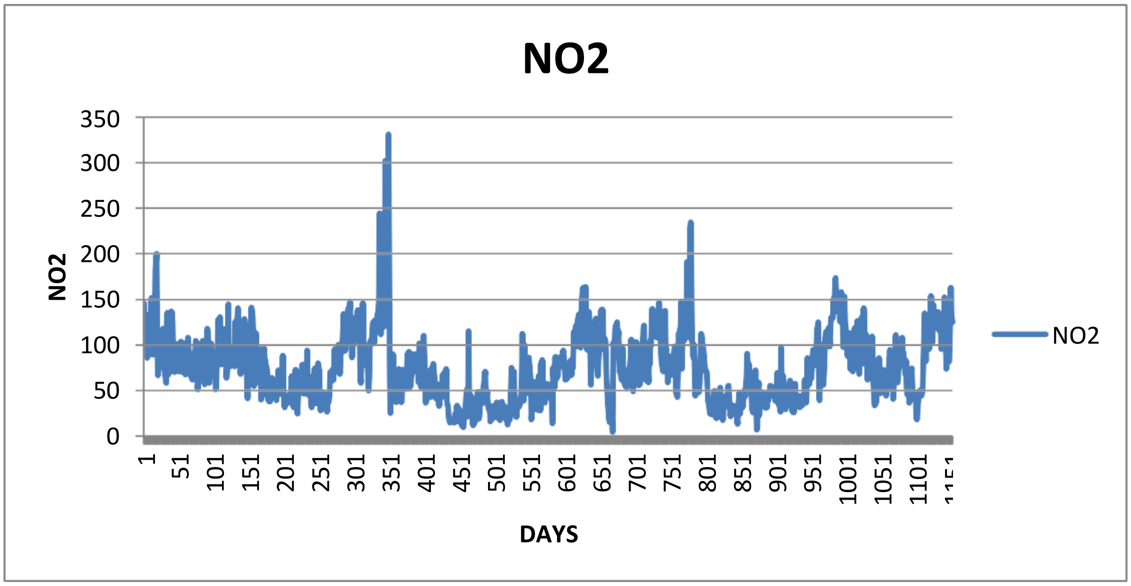
INTERPRETATION: There is a gradual increase in the amount of SO2 in the air over the period of 3.5 years, but always been with in the prescribed standards (0-80) .There is slight seasonal variation but an upward trend is present which we will examine.

LINE DIAGRAM OF CO:



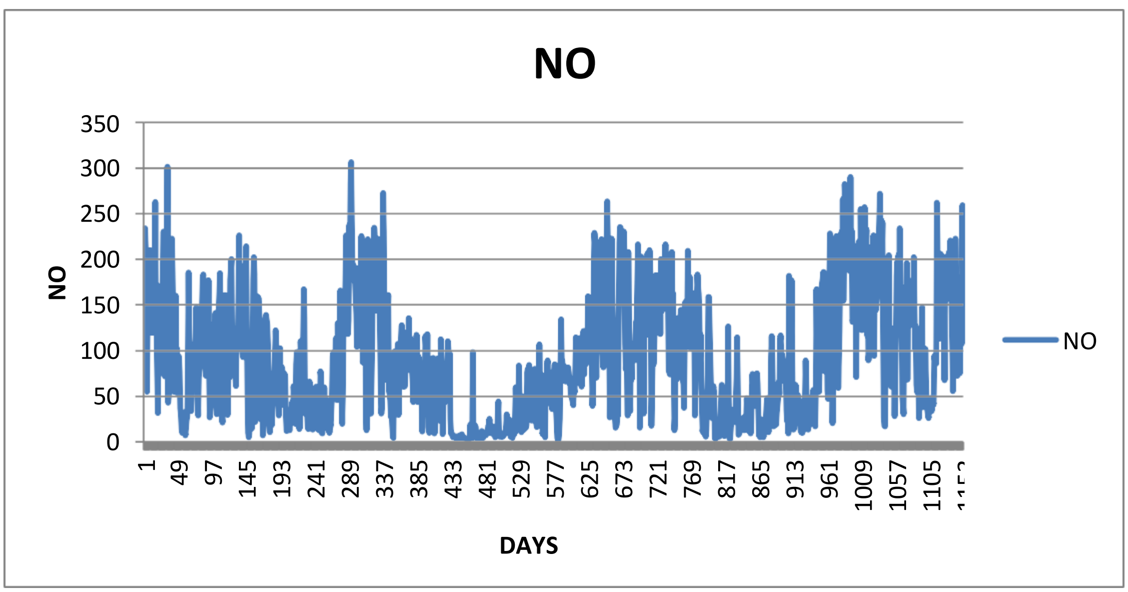
INTERPRETATION: Nothing much can be conclude by seeing the line diagram of CO, but it maintains a constant level over the period of 3.5years. There have been few days CO level is above its prescribed standards (0-4).

LINE DIAGRAM OF NO_2:



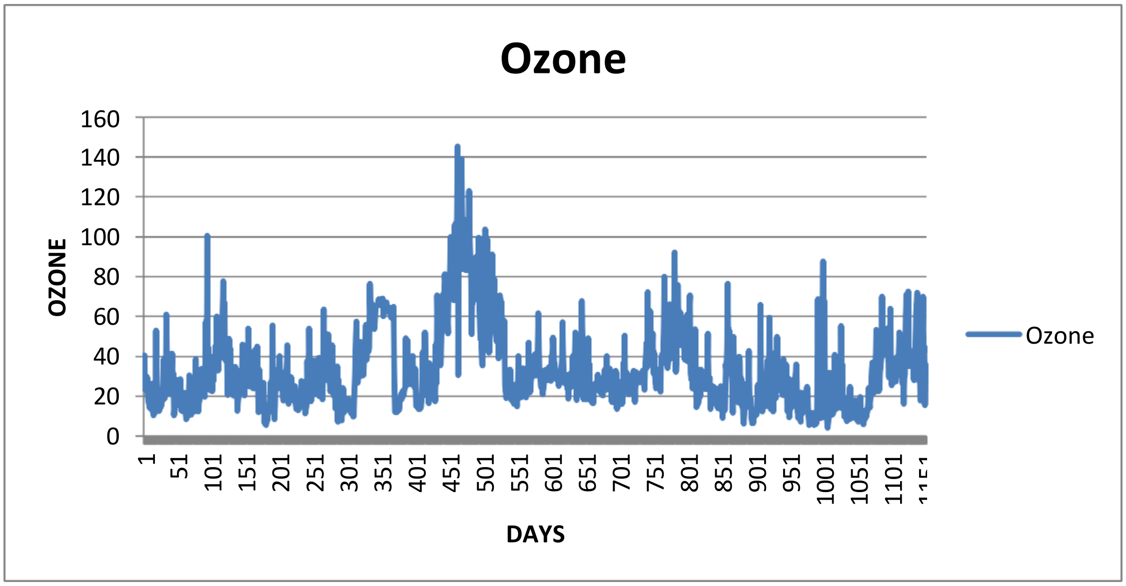
INTERPRETATION: Nothing much can be conclude by seeing the line diagram of NO_2, but it maintains a constant level over the period of 3.5years.There is a gradual decrease in the peak of NO_2 level. Most of the time NO_2 have exceeded its prescribed standards (0-80).

LINE DIAGRAM OF NO:



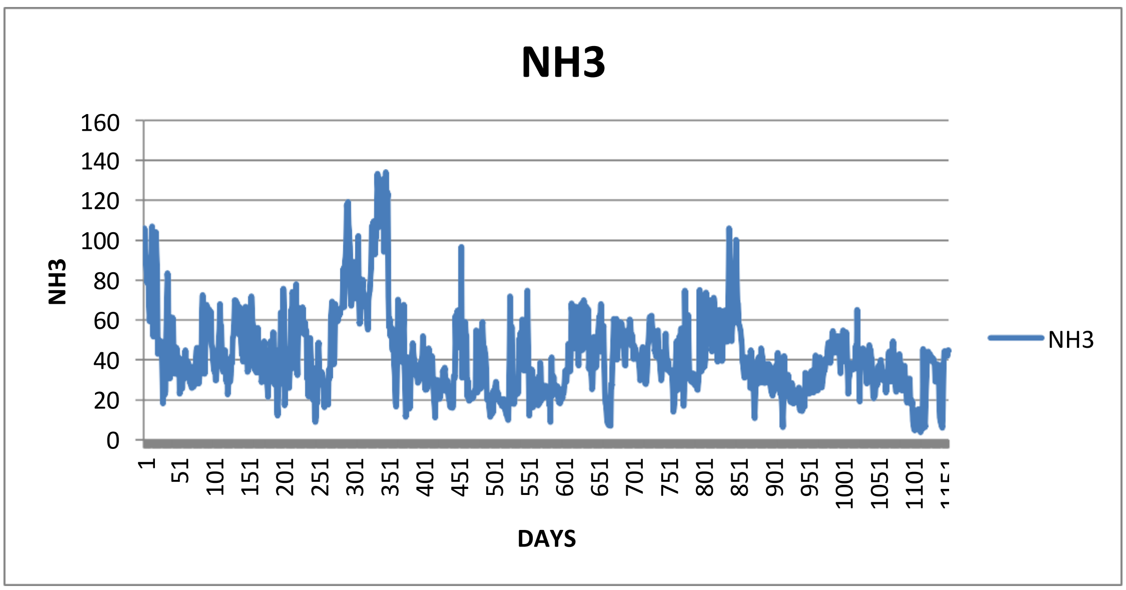
INTERPRETATION: Nothing much can be conclude by seeing the line diagram of NO, but it maintains a constant level over the period of 3.5years. Most of the time NO have exceeded its prescribed standards (0-80).

LINE DIAGRAM OF OZONE:



INTERPRETATION: The amount of Ozone maintains a constant level over the period of 3.5years,having a peak in April 2020 but always been with in the prescribed standards (0-180).

LINE DIAGRAM OF NH3:



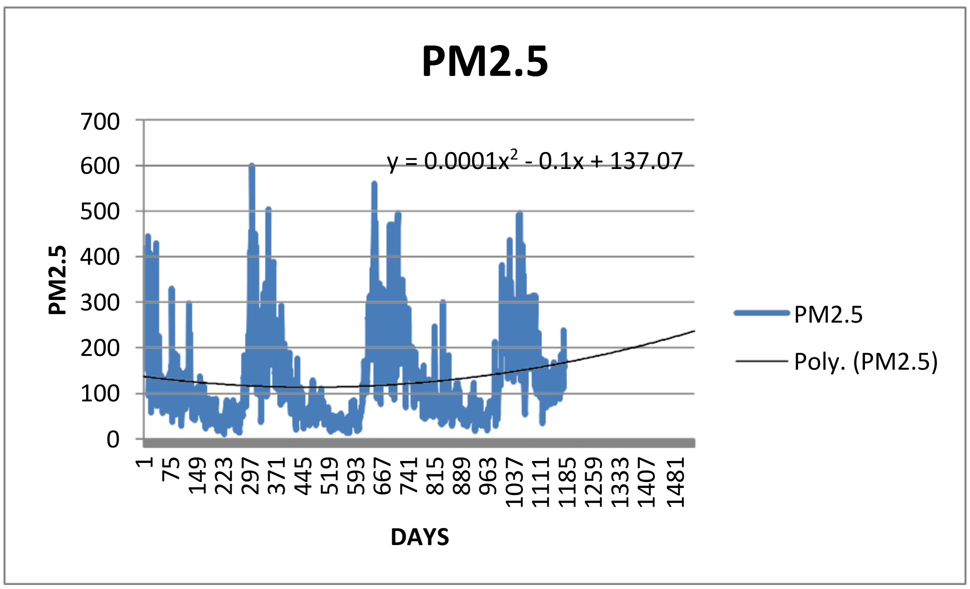
INTERPRETATION: There is a slight gradual decrease in the level of NH3 overthe period of 3.5 years. The level of NH3 has been always in the prescribed standard (0-400).

TREND ANALYSIS:

Trend Analysis plays an important role to understand the general tendency of the data to increase or decrease during a long period of time. It also enables us to forecast the behavior of the phenomenon in future.

Here, we will be identify the trends and try to fit mathematical functions like straight line, exponential curves, polynomial, logarithmic or power curve etc. using Microsoft Excel and also doing Trend Forecasting for next 1 year.

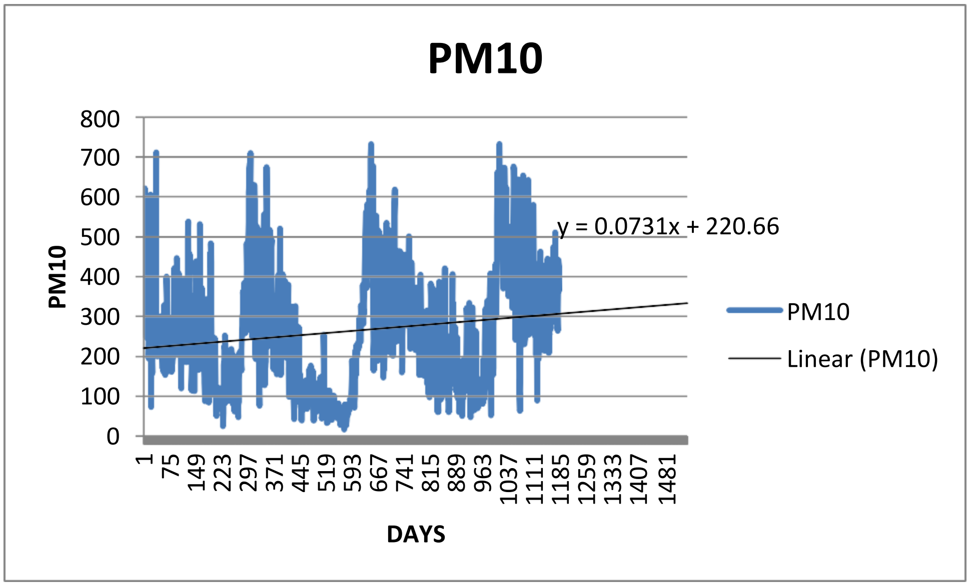
TREND OF PM2.5:



INTERPRETATION: There is an upward trend in the level of PM2.5. Here a second degree parabola curve describes the type of trends that PM2.5 exhibits.

EQUATION: $y = 0.000x^2 - 0.1x + 137.0$

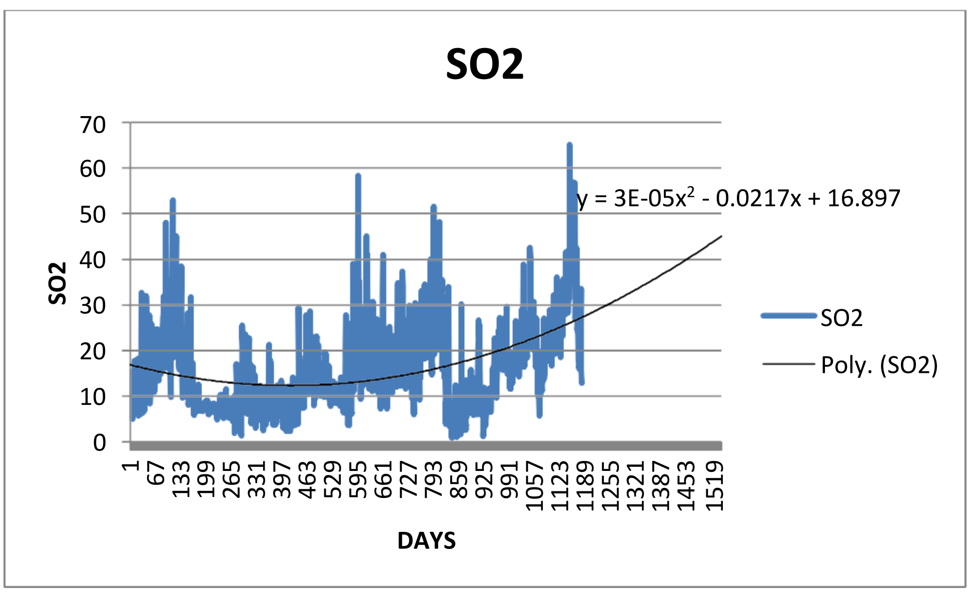
TREND OF PM10:



INTERPRETATION: There is an upward trend in the level of PM10. Here a straight line describes the type of trends that PM10 exhibits.

EQUATION: y = 0.073x + 220.6

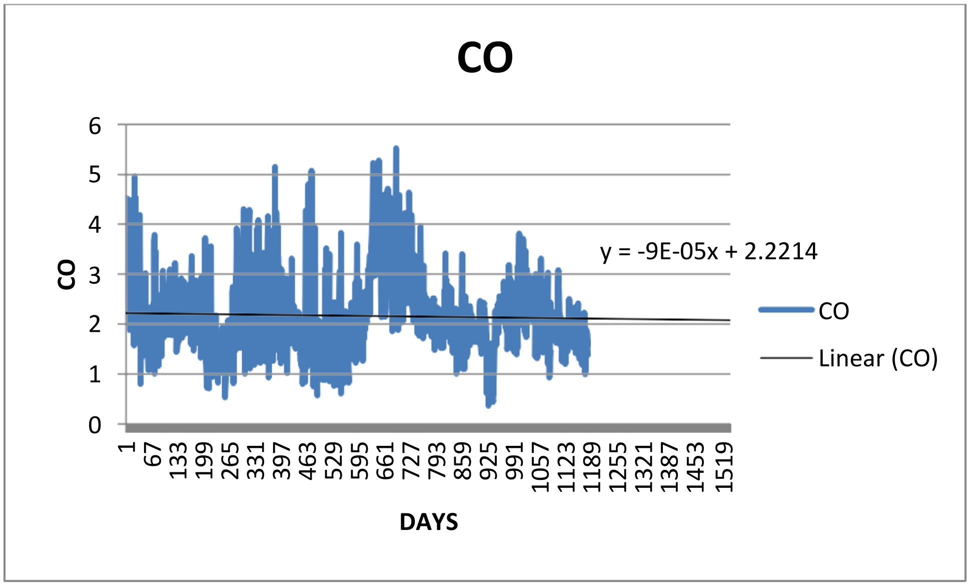
TREND OF SO2:



INTERPRETATION: There is an upward trend in the level of SO2. Here a second degree parabola curve describes the type of trends that SO2 exhibits.

EQUATION: $y = 3E\text{-}05x^2 - 0.021x + 16.89$

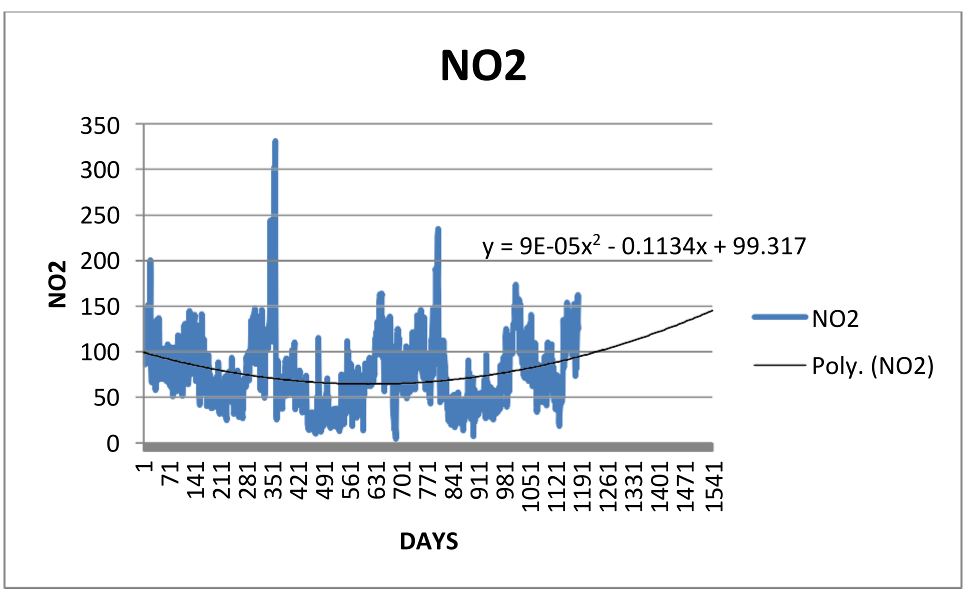
TREND OF CO:



INTERPRETATION: There is a very slide downward trend in the level of CO. Here a straight line describes the type of trends that CO exhibits.

EQUATION: $y = -9E\text{-}05x + 2.221$

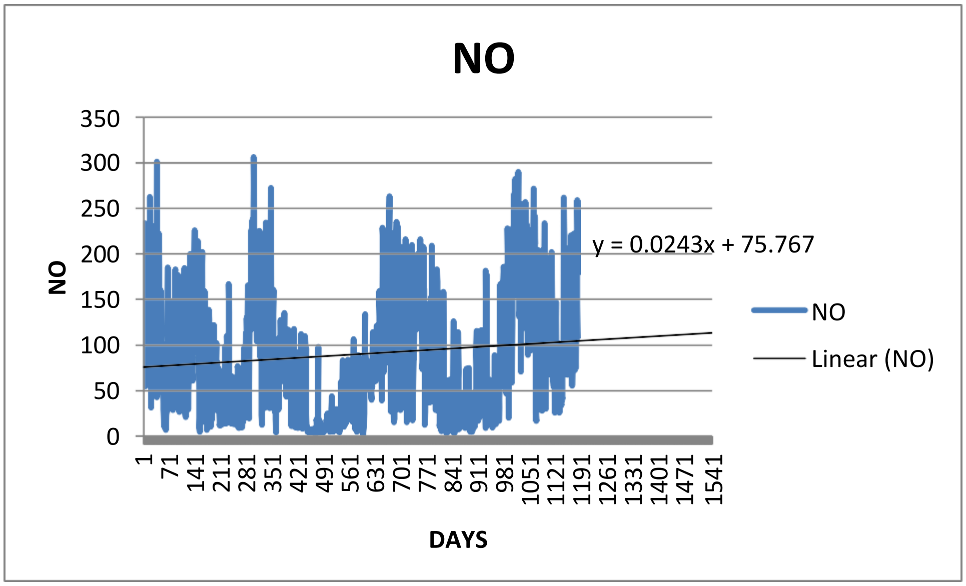
TREND OF NO2:



INTERPRETATION: The trend of NO_2 is described by a second degree polynomial (parabola)

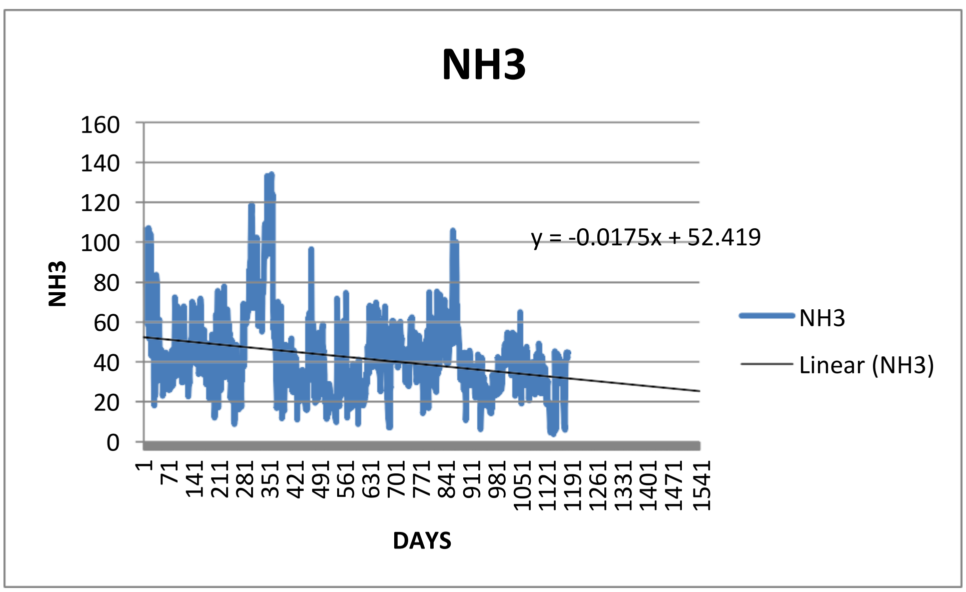
EQUATION: $y = 9E\text{-}05x^2 - 0.113x + 99.31$

TREND OF NO:



INTERPRETATION: There is an upward trend in the level of NO. Here a straight line describes the type of trends that NO exhibits.

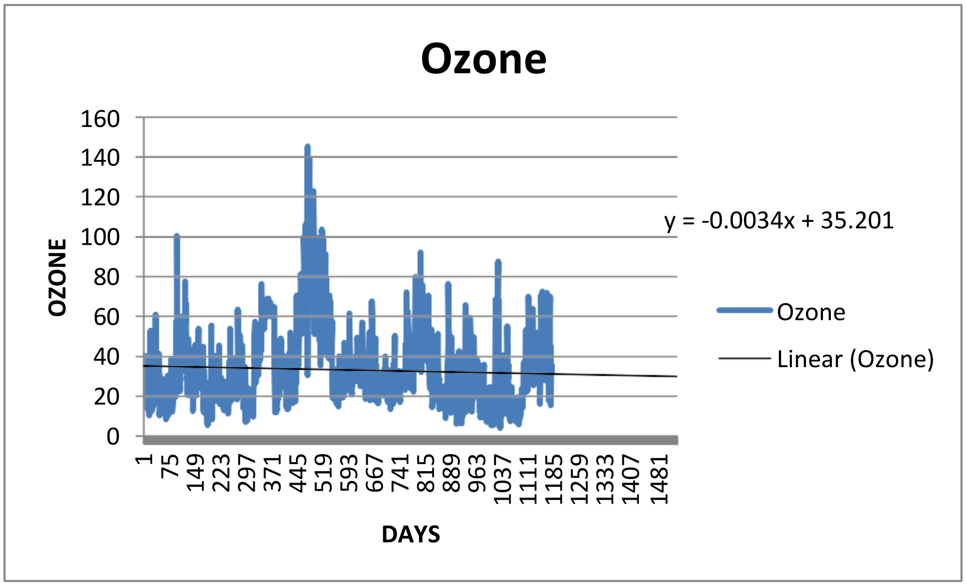
***EQUATION: $y = 0.024x + 75.76$* TREND OF NH_3:**



INTERPRETATION: There is downward trend in the level of NH3. Here a straight line describes the type of trends that NH3 exhibits.

EQUATION: y = -0.017x + 52.41

TREND OF OZONE



INTERPRETATION: There is a very slide downward trend in the level of OZONE. Here a straight line describes the type of trends that OZONE exhibits.

EQUATION: y = -0.003x + 35.20

BUILDING A TIME SERIES MODEL:

Building a time series model for the given air quality data is of vital importance for forecasting. Here we will fit a Autoregression model to each pollutant data.

AUTOREGRESSION PROCESS:

The value of a series at any time 't' may depend upon its own value at time t-1,t-2,…,t-p,(say),the relationship being linear.

Let us consider an autoregressive process of order p.

$$Y_t = \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \alpha_3 Y_{t-3} + \alpha_4 Y_{t-4} + \cdots + \alpha_p Y_{t-p} + \varepsilon_t$$

FITTING AUTOREGRESSIVE PROCESS OF ORDER 10 FOR PM2.5:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.849825
R Square	0.722202
Adjusted R Square	0.719803
Standard Error	51.94556
Observations	1169

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	9.29274	2.810374	3.306585	0.000973	3.778746	14.80673	3.778746	14.80673
X Variable 1	0.777509	0.029177	26.64768	2.1E-122	0.720262	0.834755	0.720262	0.834755
X Variable 2	-0.11729	0.037046	-3.16601	0.001586	-0.18997	-0.0446	-0.18997	-0.0446
X Variable 3	0.034195	0.037209	0.919003	0.358285	-0.03881	0.107199	-0.03881	0.107199
X Variable 4	0.035021	0.037297	0.938969	0.347943	-0.03816	0.108199	-0.03816	0.108199
X Variable 5	0.027363	0.037347	0.732662	0.463913	-0.04591	0.100639	-0.04591	0.100639
X Variable 6	0.021087	0.037348	0.56461	0.572448	-0.05219	0.094364	-0.05219	0.094364
X Variable 7	0.036227	0.037331	0.97043	0.332035	-0.03702	0.109472	-0.03702	0.109472
X Variable 8	0.0219	0.037295	0.587195	0.557187	-0.05127	0.095073	-0.05127	0.095073
X Variable 9	-0.02909	0.037128	-0.78342	0.433543	-0.10193	0.04376	-0.10193	0.04376
X Variable 10	0.118326	0.029072	4.070095	5.02E-05	0.061286	0.175365	0.061286	0.175365

AUTOREGRESSIVE MODEL:

$$Y_t = 0.777Y_{t-1} - 0.117Y_{t-2} + 0.034Y_{t-3} + 0.035Y_{t-4} + 0.027Y_{t-5} + 0.021Y_{t-6} + 0.036Y_{t-7} + 0.022Y_{t-8} - 0.029Y_{t-9} + 0.118Y_{t-10} + 9.293$$

FITTING AUTOREGRESSIVE PROCESS OF ORDER 10 FOR PM10:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.861232
R Square	0.74172
Adjusted R Square	0.73949
Standard Error	77.49367
Observations	1169

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	19.09392	5.224956	3.65437	0.000269	8.842481	29.34536	8.842481	29.34536
X Variable 1	0.81245	0.029224	27.80124	1E-130	0.755113	0.869787	0.755113	0.869787
X Variable 2	-0.1232	0.037693	-3.26863	0.001112	-0.19716	-0.04925	-0.19716	-0.04925
X Variable 3	0.055911	0.037797	1.479239	0.139348	-0.01825	0.130069	-0.01825	0.130069
X Variable 4	-0.0382	0.037842	-1.00948	0.312954	-0.11245	0.036046	-0.11245	0.036046
X Variable 5	0.073358	0.037851	1.938069	0.052858	-0.00091	0.147622	-0.00091	0.147622
X Variable 6	0.039065	0.037853	1.032011	0.302282	-0.0352	0.113333	-0.0352	0.113333
X Variable 7	-0.00828	0.037851	-0.21868	0.82694	-0.08254	0.065987	-0.08254	0.065987
X Variable 8	0.071809	0.037811	1.899169	0.057791	-0.00238	0.145994	-0.00238	0.145994
X Variable 9	-0.05717	0.037707	-1.51602	0.129786	-0.13115	0.016817	-0.13115	0.016817
X Variable 10	0.101489	0.029172	3.479019	0.000522	0.044254	0.158725	0.044254	0.158725

AUTOREGRESSIVE MODEL:

$$Y_t = 0.812Y_{t-1} - 0.123Y_{t-2} + 0.0559Y_{t-3} - 0.038Y_{t-4} + 0.0733Y_{t-5} + 0.039Y_{t-6} - 0.0083Y_{t-7} + 0.0718Y_{t-8} - 0.057Y_{t-9} + 0.101Y_{t-10} + 19.034$$

FITTING AUTOREGRESSIVE PROCESS OF ORDER 10 FOR SO2:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.791871
R Square	0.627059
Adjusted R Square	0.623838
Standard Error	5.769836
Observations	1169

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.392442	0.388103	3.587816	0.000347	0.630978	2.153906	0.630978	2.153906
X Variable 1	0.452061	0.029398	15.37729	1.07E-48	0.394381	0.50974	0.394381	0.50974
X Variable 2	0.112858	0.032229	3.501752	0.00048	0.049624	0.176091	0.049624	0.176091
X Variable 3	0.047889	0.03247	1.474887	0.140515	-0.01582	0.111595	-0.01582	0.111595
X Variable 4	0.093907	0.032495	2.889903	0.003925	0.030152	0.157663	0.030152	0.157663
X Variable 5	-0.00635	0.03257	-0.19509	0.845359	-0.07026	0.057548	-0.07026	0.057548
X Variable 6	0.05884	0.03257	1.806593	0.071085	-0.00506	0.122742	-0.00506	0.122742
X Variable 7	0.01827	0.0325	0.562163	0.574114	-0.0455	0.082036	-0.0455	0.082036
X Variable 8	0.059381	0.032479	1.828311	0.06776	-0.00434	0.123105	-0.00434	0.123105
X Variable 9	0.061369	0.03239	1.894674	0.058384	-0.00218	0.12492	-0.00218	0.12492
X Variable 10	0.017043	0.029521	0.577317	0.563837	-0.04088	0.074964	-0.04088	0.074964

AUTOREGRESSIVE MODEL:

$$Y_t = 0.452Y_{t-1} + 0.113Y_{t-2} + 0.048Y_{t-3} + 0.094Y_{t-4} - 0.0063Y_{t-5} + 0.0588Y_{t-6} + 0.018Y_{t-7} + 0.059Y_{t-8} + 0.0614Y_{t-9} + 0.017Y_{t-10} + 1.39$$

FITTING AUTOREGRESSIVE PROCESS OF ORDER 10 FOR NO:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.789675
R Square	0.623587
Adjusted R Square	0.620336
Standard Error	41.29311
Observations	1169

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	9.602114	2.393188	4.012269	6.4E-05	4.906644	14.29758	4.906644	14.29758
X Variable 1	0.667137	0.029318	22.75534	4.85E-95	0.609615	0.724659	0.609615	0.724659
X Variable 2	-0.01824	0.035435	-0.51475	0.606827	-0.08776	0.051283	-0.08776	0.051283
X Variable 3	0.049957	0.035547	1.405379	0.160177	-0.01979	0.119701	-0.01979	0.119701
X Variable 4	-0.10307	0.035545	-2.8997	0.003806	-0.17281	-0.03333	-0.17281	-0.03333
X Variable 5	0.11953	0.035633	3.354528	0.000821	0.049619	0.189442	0.049619	0.189442
X Variable 6	0.06875	0.035498	1.936735	0.053021	-0.0009	0.138398	-0.0009	0.138398
X Variable 7	0.035394	0.03542	0.999257	0.317879	-0.0341	0.104889	-0.0341	0.104889
X Variable 8	-0.0191	0.035415	-0.5392	0.589851	-0.08858	0.050389	-0.08858	0.050389
X Variable 9	0.026082	0.035501	0.734668	0.462691	-0.04357	0.095735	-0.04357	0.095735
X Variable 10	0.065681	0.029402	2.233919	0.025679	0.007994	0.123367	0.007994	0.123367

AUTOREGRESSIVE MODEL:

$$Y_t = 0.667Y_{t-1} - 0.018Y_{t-2} + 0.05Y_{t-3} - 0.103Y_{t-4} + 0.119Y_{t-5} + 0.069Y_{t-6} + 0.0354Y_{t-7} - 0.019Y_{t-8} + 0.0261Y_{t-9} + 0.0657Y_{t-10} + 9.602$$

FITTING AUTOREGRESSIVE PROCESS OF ORDER 10 FOR NO2:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.847478
R Square	0.718218
Adjusted R Square	0.715785
Standard Error	20.66276
Observations	1169

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	6.840355	1.530166	4.470335	8.58E-06	3.838147	9.842563	3.838147	9.842563
X Variable 1	0.75499	0.029315	25.75456	5.2E-116	0.697474	0.812506	0.697474	0.812506
X Variable 2	-0.09779	0.03664	-2.66907	0.007713	-0.16968	-0.02591	-0.16968	-0.02591
X Variable 3	0.067843	0.036814	1.842862	0.065605	-0.00439	0.140073	-0.00439	0.140073
X Variable 4	0.105046	0.036857	2.850123	0.004448	0.032733	0.17736	0.032733	0.17736
X Variable 5	-0.01961	0.036948	-0.53061	0.595792	-0.0921	0.052888	-0.0921	0.052888
X Variable 6	0.048047	0.036945	1.300488	0.193693	-0.02444	0.120534	-0.02444	0.120534
X Variable 7	-0.00634	0.036848	-0.17192	0.863527	-0.07863	0.065961	-0.07863	0.065961
X Variable 8	0.019213	0.036782	0.522359	0.60152	-0.05295	0.09138	-0.05295	0.09138
X Variable 9	0.102368	0.036674	2.791265	0.005337	0.030412	0.174323	0.030412	0.174323
X Variable 10	-0.06457	0.029348	-2.20004	0.028001	-0.12215	-0.00699	-0.12215	-0.00699

AUTOREGRESSIVE MODEL:

$$Y_t = 0.755Y_{t-1} - 0.0978Y_{t-2} + 0.068Y_{t-3} + 0.105Y_{t-4} - 0.0196Y_{t-5} + 0.048Y_{t-6} - 0.006Y_{t-7} + 0.019Y_{t-8} + 0.1024Y_{t-9} - 0.0646Y_{t-10} + 6.84$$

FITTING AUTOREGRESSIVE PROCESS OF ORDER 10 FOR NH3:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.877379
R Square	0.769793
Adjusted R Square	0.767805
Standard Error	9.997456
Observations	1169

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.503506	0.747159	4.689105	3.07E-06	2.037569	4.969442	2.037569	4.969442
X Variable 1	0.820528	0.029373	27.93495	1.1E-131	0.762898	0.878158	0.762898	0.878158
X Variable 2	-0.09594	0.037976	-2.52641	0.011656	-0.17045	-0.02143	-0.17045	-0.02143
X Variable 3	0.082095	0.03806	2.156974	0.031213	0.00742	0.15677	0.00742	0.15677
X Variable 4	-0.03526	0.038074	-0.92607	0.354603	-0.10996	0.039443	-0.10996	0.039443
X Variable 5	0.097132	0.038082	2.550586	0.010882	0.022414	0.171851	0.022414	0.171851
X Variable 6	0.023669	0.03807	0.621717	0.534251	-0.05103	0.098363	-0.05103	0.098363
X Variable 7	0.047197	0.038056	1.240204	0.215151	-0.02747	0.121862	-0.02747	0.121862
X Variable 8	-0.03254	0.038007	-0.85622	0.392054	-0.10711	0.042028	-0.10711	0.042028
X Variable 9	0.03815	0.037882	1.00709	0.314102	-0.03617	0.112475	-0.03617	0.112475
X Variable 10	-0.02962	0.029289	-1.01127	0.312097	-0.08709	0.027847	-0.08709	0.027847

AUTOREGRESSIVE MODEL:

$$Y_t = 0.821Y_{t-1} - 0.096Y_{t-2} + 0.0821Y_{t-3} - 0.035Y_{t-4} + 0.097Y_{t-5} + 0.024Y_{t-6} + 0.047Y_{t-7} - 0.033Y_{t-8} + 0.038Y_{t-9} - 0.03Y_{t-10} + 3.504$$

FITTING AUTOREGRESSIVE PROCESS OF ORDER 10 FOR OZONE:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.833816
R Square	0.695249
Adjusted R Square	0.692618
Standard Error	11.42985
Observations	1169

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.382072	0.717232	3.321201	0.000924	0.974852	3.789292	0.974852	3.789292
X Variable 1	0.536068	0.029384	18.24377	1.46E-65	0.478417	0.593719	0.478417	0.593719
X Variable 2	0.092674	0.033223	2.789465	0.005366	0.02749	0.157858	0.02749	0.157858
X Variable 3	0.061795	0.033421	1.848983	0.064715	-0.00378	0.127368	-0.00378	0.127368
X Variable 4	0.06387	0.033415	1.911419	0.056197	-0.00169	0.12943	-0.00169	0.12943
X Variable 5	-0.08099	0.033425	-2.42301	0.015545	-0.14657	-0.01541	-0.14657	-0.01541
X Variable 6	0.05916	0.033513	1.765298	0.077777	-0.00659	0.124913	-0.00659	0.124913
X Variable 7	0.093343	0.033491	2.787077	0.005406	0.027633	0.159054	0.027633	0.159054
X Variable 8	0.00655	0.033567	0.195122	0.845332	-0.05931	0.072409	-0.05931	0.072409
X Variable 9	0.095923	0.033563	2.858015	0.004339	0.030072	0.161774	0.030072	0.161774
X Variable 10	0.001408	0.029664	0.047466	0.96215	-0.05679	0.059609	-0.05679	0.059609

AUTOREGRESSIVE MODEL:

$$Y_t = 0.5361Y_{t-1} + 0.0927Y_{t-2} + 0.062Y_{t-3} + 0.064Y_{t-4} - 0.081Y_{t-5} + 0.059Y_{t-6} + 0.0933Y_{t-7} + 0.0066Y_{t-8} + 0.096Y_{t-9} + 0.0014Y_{t-10} + 2.382$$

FITTING AUTOREGRESSIVE PROCESS OF ORDER 10 FOR CO:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.652178
R Square	0.425336
Adjusted R Square	0.420373
Standard Error	0.624886
Observations	1169

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.361773	0.070307	5.145591	3.13E-07	0.223829	0.499717	0.223829	0.499717
X Variable 1	0.420126	0.029392	14.29396	8.32E-43	0.362459	0.477793	0.362459	0.477793
X Variable 2	0.123366	0.031769	3.883185	0.000109	0.061034	0.185697	0.061034	0.185697
X Variable 3	0.018603	0.031961	0.582063	0.560638	-0.0441	0.081311	-0.0441	0.081311
X Variable 4	0.070734	0.03184	2.221588	0.026504	0.008265	0.133204	0.008265	0.133204
X Variable 5	0.022681	0.031899	0.711024	0.477213	-0.0399	0.085266	-0.0399	0.085266
X Variable 6	-0.0116	0.031847	-0.36433	0.715678	-0.07409	0.050882	-0.07409	0.050882
X Variable 7	0.089551	0.031802	2.815894	0.004947	0.027155	0.151946	0.027155	0.151946
X Variable 8	0.002059	0.031907	0.064524	0.948564	-0.06054	0.06466	-0.06054	0.06466
X Variable 9	0.086328	0.031696	2.723672	0.006553	0.024141	0.148516	0.024141	0.148516
X Variable 10	0.009157	0.029186	0.313734	0.753779	-0.04811	0.06642	-0.04811	0.06642

AUTOREGRESSIVE MODEL:

$$Y_t = 0.42Y_{t-1} + 0.123Y_{t-2} + 0.0186Y_{t-3} + 0.071Y_{t-4} 0.023Y_{t-5} - 0.012Y_{t-6} + 0.09Y_{t-7} + 0.0021Y_{t-8} + 0.086Y_{t-9} + 0.009Y_{t-10} + 0.362$$

FINDINGS:

There is a serious upward trends for the pollutants like PM2.5, PM10, SO2, NO2,NO where as pollutants like NH3, OZONE shows a downward trends over a period of 3 years 4 months. And though CO shows very small (negligible) downward trends , we can consider its showing almost constant trend. Pollutants like PM2.5, PM10 have seasonal variation with period of almost 1 year. We have also fit autoregressive model of order 10 for each pollutant which could help us forecasting the future condition of Air Quality in Anand Vihar, Delhi.

CONCLUSION:

The level of Pollutants like PM2.5, PM10, SO2, NO2, NO will increase with a good amount in near future if no further measure is taken in controlling the air pollution. Though CO is maintaining a constant trends but the level may also in future. Apart from all that, the amount of OZONE and NH3 will decrease which is a good sign. Nevertheless we should take steps to improve air quality specially PM2.5 and PM10 .since they are already above their prescribed range and several health issues related to lungs ,eye, throat can occur.

BIBLIOGRAPHY:

SOURCE OF THEORY:

- Fundamental of Statistics (Volume One & Two)- A.M. Goon, M.K. Gupta, B. Dasgupta

SOURCE OF DATA:

- https://airquality.cpcb.gov.in/ccr/#/caaqm-dashboard-all/caaqm-landing

SOFTWARES USED:

- Microsoft Word
- Microsoft Excel