Ozonosphere Dilution and Its Trend

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Abstract: ***Purpose**: Antractide Pole measurements show increased UV radiation. These increasing values of radiation can be attributed to the deep ozone "hole" which is concentrated in the South Pole. The study identifies Ozone deficiency in the Troposphere. **Methodology**: The thought is grounded in the comparison between the data of Ozone from Automatic urban air monitoring stations(SA) in Albania (2 pcs) and some SA(19 pcs)around the world EPA, analyzing future prospects. **Results**: Ozone values in Winter, droop according to a polynomial curve R2 = 0.979. The minimum is in December. The distribution of the minimum value is: December 52%, February 14%, September, 14%, August 10% October, 5% November5%. In the Urban Area, monthly mean ozone concentration in the summer months grows, while overnight for the same period decrease. Reduce concentration at night, occurs according to a polynomial curve R2 = 0.955. Increasing temperatures, reflects with increasing Ozone concentration in July and August. In other months, like rising temperatures so also lowering temperatures, accompanied with a decrease in the concentration of Ozone. In an urban center, concentration over 3 years of NO and O3 has exponential behavior from year to year, specifically: Nitrous Oxide NO: R^2 = 0.862 increase exponential, Ozone O_3: R2 = 0.948, there is a discount exponentially. **Conclusion**: Low value of Ozone in winter season to all stations, as well lower values at stations near the pole; prove the connection that Solar radiation has in his concentration. Increasing the average monthly value in Summer, is dedicated to Photolysis reactions. Reduce the concentration of Ozone at night, comes from urban pollution. Increasing urban pollution, year by year, is lowering the concentration of Ozone in the Troposphere towards minimum values. **Discussion**: Completion recognized by NASA; addition of UV radiation, is happening as a result of the enlargement of the holes to Ozonein the Ozonosphere in the South Pole,exceptthe impact of CFCs, identified as Ozone consumers can be added as well the impact of the concentration change of Nitrogen Oxideand Ozone in the Troposphere.*

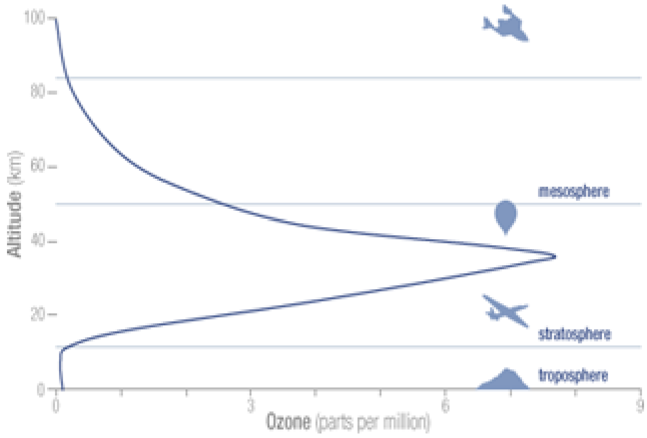
Keywords: WHO- World Health Organization, IPH- Institute of Public Health.EPA- Environmental Protection Agency,SA- Automatic Urban Pollution Monitoring Stations. tr cent-short for SA in the center of Tirana. iph- short for SA in near of IPH.MD-master's degree

1. Introduction

Interest in damage to the environment from Anthropogenic pollutants began when industrial emissions became a cause for high morbidity in humans. This concern, it became even more alarming when started linking morbidity by ultraviolet radiation also and Global Climate Change.

1.1 Ozone

Ozone is a molecule with three oxygen atoms. Ozone is formed by the action of ultraviolet light, and also, by atmospheric electrical discharges. Ozone is present at low concentrations throughout the Earth's atmosphere. In total, Ozone accounts for only 0.6 ppm of the atmosphere. In the stratosphere 18-48 km from the Earth's surface, Ozone forms a delicate layer and very important for life on Earth as much as Oxygen itself. In the article"Atmospheric Ozone Imaging, Data and Information" Low Ozone Ozone Concentration is According to the Curve(fig.1) "and its dilution causes increased UV radiation. Related to this increased level of UV radiation, there is a focus pronounced of the disease caused for skin cancer resulting from high levels of UVB and UV radiation [1].



According to According to NASA's Earth Observatory 2003 in the article: “Chemistry of Ozone Formation” In the troposphere near the Earth’s surface, ozone forms through the splitting of molecules by sunlight as it does in the stratosphere. However in the troposphere, nitrogen dioxide, not molecular oxygen, provides the primary source of the oxygen atoms required for ozone formation. Sunlight splits nitrogen dioxide into nitric oxide and an oxygen atom.

$$NO_2 + \text{sunlight} \rightarrow NO + O \qquad (Reaction\ 5)$$

A single oxygen atom then combines with an oxygen molecule to produce ozone.

$$O + O_2 \rightarrow O_3 \qquad (Reaction\ 6)$$

Ozone then reacts readily with nitric oxide to yield nitrogen dioxide and oxygen.

$$NO + O_3 \rightarrow NO_2 + O_2 \qquad (Reaction\ 7)$$

The process described above results in no net gain in ozone. Concentrations occur in higher amounts in the troposphere than these reactions alone account for. In the 1950s, chemists discovered that two additional chemical constitutents of the troposphere contribute to ozone formation[2]. According to NASA's September 2018 observation, in the South Pole: in art "Protection of the ozone layer" the picture as in fig 2 .Actions required globally to continue the recovery of the ozone layer are: Reducing use of ozone-depleting substances in applications that are not considered as consumption under the Montreal Protocol. Ensuring that no new chemicals or technologies emerge that could pose new threats to the ozone layer (e.g. very short-lived substances) [3]. According to the EPA. 2016 is not an art "Environmental Effects of Ozone Depletion"The level of UV radiation is increasing,The maximum value is reached in December fig. 3[4]

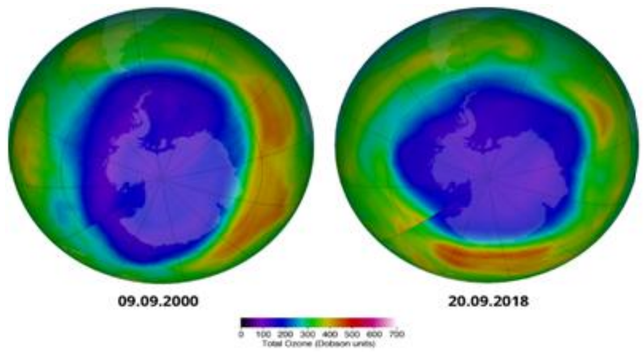


Figure 2

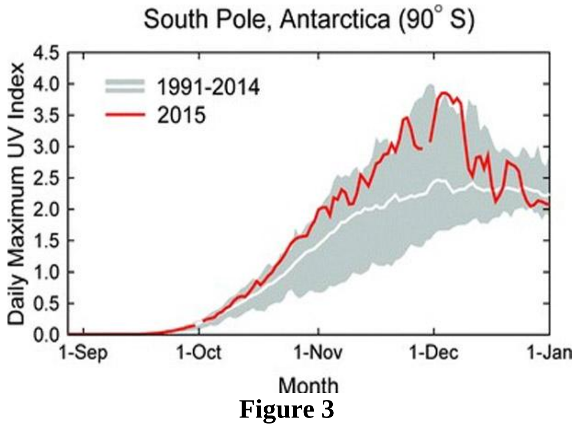


Figure 3

This study was inspired by:

a) I-Article: New Zealand 2009; where in clarification of the question of: what is NO? , clarifies that "NO nitrogen oxide is considered an air pollutant, responsible for the disappearance of the ozone layer "[5].
b) II The data for Ozone Monitoring by two automatic urban air assembly stations we Institute of Public Health. Tirana Albania [6].

2. Materials and Methods

In this study they were analyzed:(I) Data of the two automatic stations for the period 2016-2019 in Albania.(II) Data on 19 Automatic Stations According to EPA "Real-Time Air Quality Index ", in Australia, Africa, Brazil, Chile, Albania, France, Spain, Canada[7].(III) Data of Meteorological temperature for 2016-2019,by IGJEUM [8]. For analysis was used method of comparison.

3. Results

The Winter: Reference to Article "Ozone Chronobiology" From the data of the automatic stations in the center of Tirana and at the Institute of Public Health for years; 2012-2013, 2016-2017 ne tabelen 1 is that:

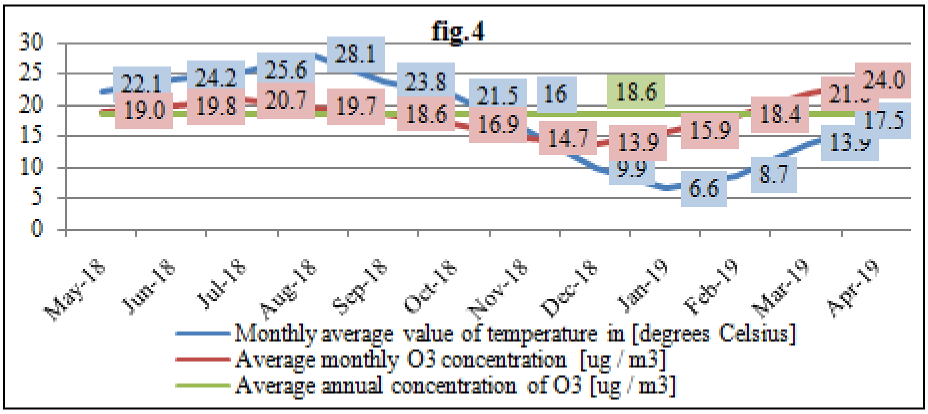
Tabela nr 1	Qëndër / Urban center			Periferi/ Periphery urban		
	ska	<=18h	<=25 dite	s'ka	<=18h	<=25 dite
Standarti	NOx>200* µg/m3	NO2>200 µg/m3	O_3>120 µg/m3	NOx>200*µg/m3	NO2>200µg/m3	O_3>120 µg/m3
2012-2013	268	0	77	0	0	0
2016-2017	632	12	0	6	0	0
(*)From the data it results that for 100% NOx is composed (NO=37% dhe NO2=63%)						

Ozone reduction (Hours above 120ug / m3)when the concentration of NOx increases, indicates for Ozone consumption. Ozone consumption that occurs according to the scheme $AO_x + O3 \rightarrow AO_{x+1} + O2$ occurs in areas with pollution[9]. Referred to this conclusion were analyzed the data for some automatic urban air monitoring EPA's "Real-Time Air Quality Index" also for 19 stations

Table 2 shows the data, for the Ozone period May 2018-April 2019, for all stations

Table 2	Australi				Afrike				Brazil				Kili			Albania		France	Spanje	Canada		
Sipas hemisferes	O3 st.40 Morwell	O3 st.30 Mooroolbark	O3 st.31 Melton	O3 st.37 Churchill	O3 st.25 Bongani	O3 st.18 Mokopane	O3 st.162 Mokopane	O3 st.18 Witbank	O3 st.10 Presidente	O3 st.17 Marília	O3 st.14 Jaú,	O3 st.13 Bauru	O3 st.28 Universidad	O3 st.38 lineares	O3 st.44 U.C. Maule	O3tr.cen AL	O3 iph	O3 st.31	O3 St.28	O3 viti 2019 st.15	O3 viti 2019 st.37	Mes vjet

May-18	18.9	20.6	23.3	18.9	17.0	15.3	15.3	14.3	24.8	25.1	25.7	25.5	17.9	17.9	17.9	1.6	11.1	37.4		16.0	16.5	19.0
Jun-18	20.7	24.3	21.7	20.7	16.5	16.5	16.5	13.7	26.3	27.5	28.2	28.0	19.8	21.1	19.8	4.7	9.8	38.9		11.6	10.0	19.8
Jul-18	22.5	27.5	21.1	22.5	17.5	13.9	13.9	9.0	26.4	28.0	27.7	28.1	16.0	21.1	19.8	10.4	14.4	54.3		10.5	9.9	20.7
Aug-18	20.5	24.0	19.2	20.5	15.5	10.9	10.9	9.3	26.2	24.7	22.9	23.9	21.4	21.4	21.4	11.1	27.5	43.0		10.1	9.4	19.7
Sep-18	16.2	23.0	17.0	16.2	16.1	11.4	11.4	10.2	22.8	22.0	23.0	23.7	18.7	20.7	18.7	7.7	23.6	39.1	33.2	8.2	8.7	18.6
Oct-18	19.5	19.7	21.4	19.5	13.5	13.0	13.0	6.0	25.0	25.7	24.2	23.1	16.2	16.2	16.2	1.9	13.2	25.8	23.8	9.0	9.3	16.9
Nov-18	16.8	16.1	22.3	16.8	12.8	15.1	15.1	10.8	25.9	24.0	22.4	22.9	8.3	8.3	8.3	2.0	9.9	14.2	19.4	7.0	10.2	14.7
Dec-18	14.8	14.1	22.2	14.8	10.0	15.3	15.3	14.7	27.9	25.3	23.6	22.4	9.1	9.1	9.1	1.4	6.3	12.8	11.7	5.6	6.4	13.9
Jan-19	17.6	14.5	24.1	17.6	10.1	15.5	15.5	13.5	26.6	28.4	28.3	24.5	8.3	8.3	8.3	2.9	14.7	20.1	16.1	7.7	10.6	15.9
Feb-19	19.0	19.6	23.0	19.0	11.5	17.4	17.4	21.2	29.9	31.4	31.4	27.3	5.6	5.6	5.6	4.4	24.4	22.5	26.9	11.5	12.1	18.4
Mar-19	20.6	21.2	24.1	20.6	16.4	17.3	17.3	22.8	35.8	38.1	37.8	33.3	8.2	6.0	8.2	3.7	29.3	31.3	35.6	13.9	15.5	21.8
Apr-19	21.1	22.7	25.6	21.1	17.2	18.5	18.5	29.5	40.1	46.4	42.2	39.1	6.8	6.8	7.0	4.1	28.9	38.3	36.8	16.8	17.3	24.0



In Figure 4, are presented:

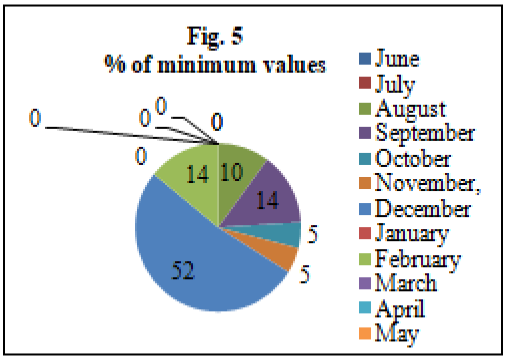
a) Monthly average value of Ozone (red ine) for all stations,
b) Ozone Annual Average Value (green line) for all stations,
c) The average monthly temperature value (blue line) for the city of Tirana.

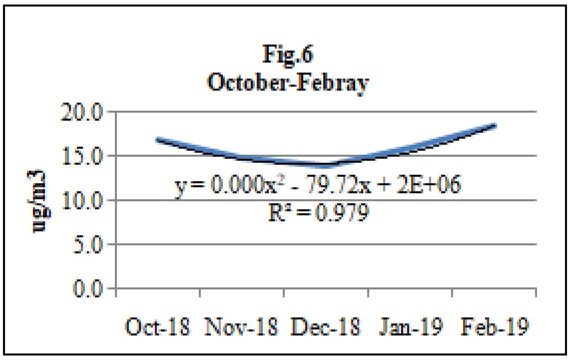
Low values of Ozone and temperature correspond to the Winter months.

The distribution of minimum values of Ozone is as in tab.3.

Tabela nr 2	Distribution of minimum O3 values in months and seasons of the year																		
	Nr stac.	June	July	August	September	October	November,	December	January	February	March	April	May	Summer	Autumn	Winter	Spring	SUMMER	WINTER
nr	21			2	3	1	1	11		3	0	0	0	2	5	14	0	2	19
% of minimum values		0	0	10	14	5	5	52	0	14	0	0	0	10	24	67	0	10	90

The minimum value is distributed, in Fig 5: December 52%, February 14% September, 14%, August 10% October, 5% November5%. For all station curves, the parabola equation Y = 0.871x2-4.811x + 20.8 with coefficient of linear deviation (mean) R2 = 0.979.Figure 6

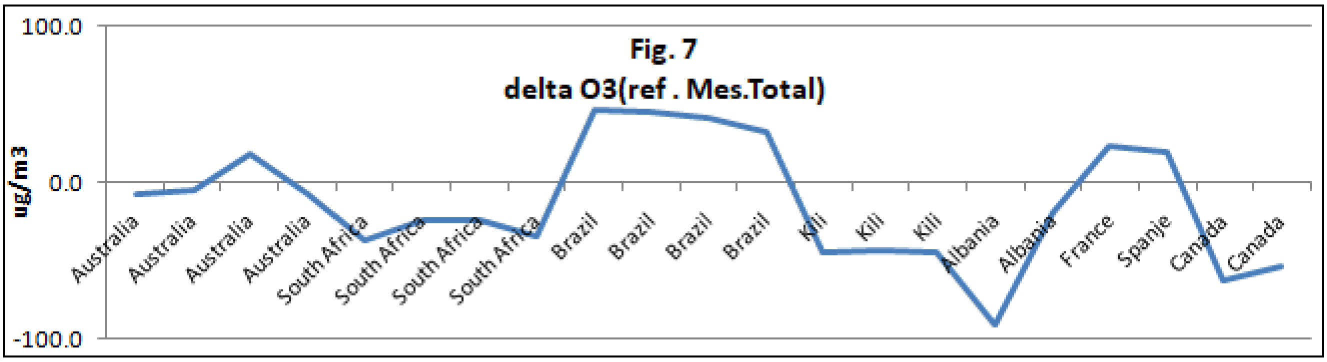




The Ozonic Winter

Changes in Annual Concentration,during the Winter (September-February) ,for each of the stations,is in Table 3 / Figure 7

Tabela 3	Australia	Australia	Australia	Australia	SouthAfrika	South Afrika	South Afrika	South Afrika	Brazil	Brazil	Brazil	Brazil	Kili	Kili	Kili	Albania	Albania	France	Spanje	Canada	Canada
	O3 st.40 Morwell	O3 st.30 Mooroolbark	O3 st.31 Melton	O3 st.37 Churchill	O3 st.25 Bongani	O3 st.18 Mokopane	O3 st.162 Mokopane	O3 st.18 Witbank	O3 st.10 Presidente	O3 st.17 Marilia	O3 st.14 Jaú,	O3 st.13 Bauru	O3 st.28 Universidad	O3 st.38 lineares	O3 st.44 U.C. Maule	O3 tr.cen	O3 iph	O3 st.31	O3 St.28	O3 viti 2019 st.15	O3 viti 2019 st.37
delta O3(ref . Mes.Total)	-7.7	-4.6	18.4	-7.7	-37.7	-24	-24	-35.1	46.5	45.1	41.2	32.5	-45.5	-43.5	-45.5	**-91.3**	**-19.5**	22.9	19.6	-62.6	-54.3

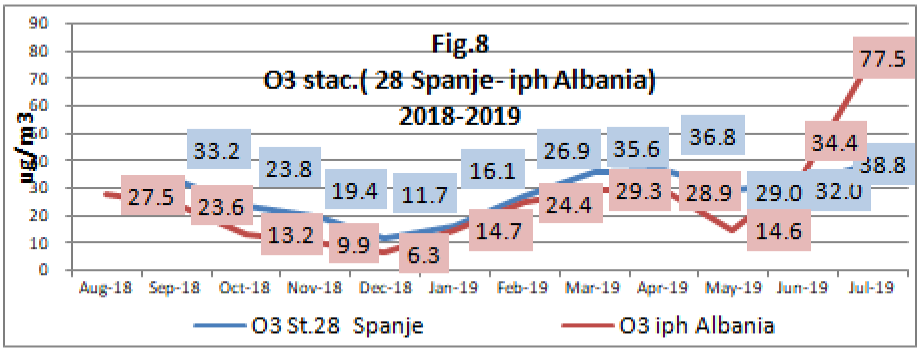


The highest value than the average is: at a station in Austarali; Brazil's 4 stations; Spain and Frances Station.

The low values are: Australia's three stations; 4 stations in South Africa; 3 Chile stations; 2 stations in Albania(owned by the Institute of Public Health) and and 2 stations of Canada. Negative values indicate an "Ozone Winter".

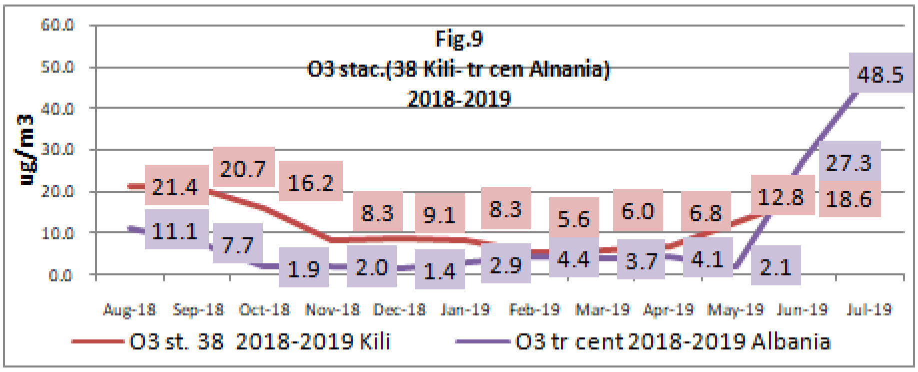
Changing the angle of sunlight on Earth, creates the Winter in Pole, so also the lack of Ozone in places near the poles it's justified. but what is visible it is Lack great Ozoneat the Center Station in Albania. Ozone deficiency at downtown station (tr. cents)) is -91.3 ug / m3 while at the IPH station it is -19.5 ug /m3. *Ozone deficiency at tr cent. is 4.6 times*.

For the reliability of the values of Albania are presented together:
1-In the fig.8 the average monthly concentration of O3 Ozone for stations (Spain-iph Albania)



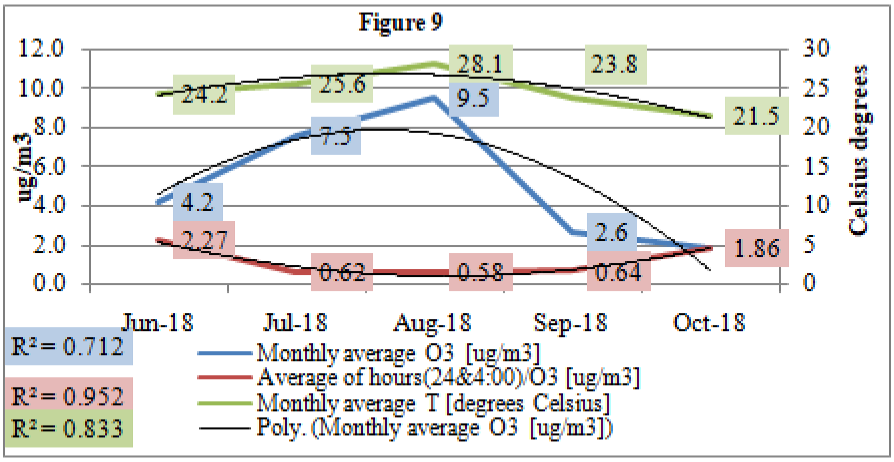
The approximate values of O3 between the stations of Spain and the station of iph Albania are coherent with the Natural Winter. In fig.9 the average monthly concentration of O3 Ozone for stations (Chile-tr cent. Albania).

Values of Ozone in the urban center "tr cent" , are in keeping with Chile's station values.When Ozone is Consumed?



"Winter's Urban"

Given the lack of Ozone 4.6 times in the Urban Center, across the suburbs; were analyzed data for 2018 for the period June-October per SA in the center of Tirana. Figure 10 shows the: Aaverage monthly values and Average values for of 24:00 and 04:00 hours. Monthly average temperature in degrees Celsius.



In an urban area, Increase in temperature during Summer according to a polynomial curve R2 = 0.833, is associated with an increase in the monthly mean ozone concentration, but according to the same behavior R2 = 0712. Ozone concentration at night, decreases by a polynomial curve R2 = 0.955.

a) Increasing the average monthly value in Summer, is dedicated to Photolysis reactions.
b) Reduce the concentration of Ozone at night,in an urban area,which is most evident in Summer, tells about its consumption,from urban pollution

The Trend

In view of this objective, for the station in the urban center, were analyzed average monthly valuefor a period of 3 years August 2016-July 2019. For the same period were observed also temperature data. For the same period, the trend of change in temperature was observed and ozone concentration for each month. The data are presented in Table 4.

Table 4	Temperatures		O3 tr cent	
	Ekuacioni	R2	Ekuacioni	R2
January	y=0.4x+5.7	0.109	y=-14.2x+54.6	0.717
February	y=-1.4x+14.4	0.901	y=-10.1x+40.9	0.698
March	y=0.5x+11.7	0.856	y=-15.3x+60.3	0.768
April	y=0.8x+14.7	0.22	y=-18.3x+70.6	0.704
May	y=1.0x+16.5	0.3	y=-17.1x+65.7	0.705
June	y=1.0x+21.7	0.88	y=-7.5x+47.3	0.157
July	y=0.3x+25.3	0.302	y=3.4x+23.4	0.028
August	y=1.5x+23.6	0.959	y=5.3x+17.7	0.156
September	y=1.6x+18.3	0.772	y=-21.6x+75.6	0.949
October	y=2.8x+12.6	0.815	y=-21.1x+66.4	0.987
November	y=2.5x+8.5	1	y=-8.5x+28.3	0.984
December	y=2.2x+3.6	0.923	y=-7.4x+21.4	0.76
R^2_{mes}		**0.669**		**0.634**

According to the table 4 the behavior of:

1- *Temperatures:* In February it decreases linearly. In other months it grows linearly.

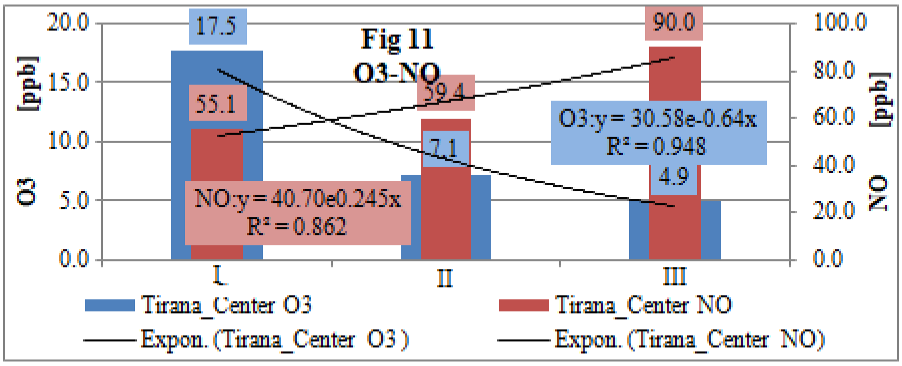
2 -*Ozone*: The linear increase in temperature reflects with linear increase in Ozone concentration,only in July and August. In other months,Ozone concentration comes down.

The question is:What is the cause?

Indicators of urban pollution

At the urban center station, for the period 2016-2019, the data for Nitrogen Oxide NO and Ozone O3, only for 4 o'clock. The data are divided into three periods(I.2016-2017; II.2017-2018; III.2018-2019), are as in Fig. 11.

Nitrogen oxide NO, increases concentration year by year, versus an exponential curve R2 = 0.862. Ozone O3 for the same period. lowers concentration versus an exponential curve R2 = 0.948.



4. Conclusions

1) Low value of Ozone in winter season to all stations, as well lower values at stations near the pole; prove the connection that Solar radiation has in his concentration.
2) Increasing the average monthly value in Summer, is dedicated to Photolysis reactions.
3) Reduce the concentration of Ozone at night, comes from urban pollution.
4) Increasing urban pollution, year by year, is lowering the concentration of Ozone in the Troposphere towards minimum values

5. Discussion

Completion recognized by NASA; addition of UV radiation, is happening as a result of the enlargement of the holes to Ozone in the Ozonosphere in the South Pole, except the impact of CFCs, identified as Ozone consumers can be added as well the impact of the concentration change of Nitrogen Oxideand Ozone in the Troposphere.

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