INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Variation in Total Ozone Content and Solar UV Index over a High Altitude Station Bangalore for a Decade 2006-2015: A Qualitative Review

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Abstract:
Bangalore is the third most populous cities of India with a total population of over 11.5 million. This city has witnessed a huge growth in its population between years 2001 (5.1 million) to 2016(11.5 million). Bangalore lies approximately at a height of 3000 ft. above sea level and positioned at 12.96^{0}N, 77.56^{0}E latitude and longitude. Because of its elevation it enjoys cool climatic conditions yearlong when compared to other stations in India. However huge increase in population enhances urbanization which leads to severe anthropogenic activity in this station. Keeping this in view an attempt was made to study the incoming solar ultraviolet radiation for the period 2006-2015 and its impact if any on this station. It is observed that the UV Index at Bangalore has a minimum value of 9.15 and a maximum value of 13.4 for this decade 2006-2015. This indicates that the city is receiving maximum ultraviolet radiation with high to very high risk. Keeping this in view measures need to be taken for safeguarding the people of Bangalore from ultraviolet radiation.

Keywords: *Total Ozone content, UV-Index, TEMIS, OMI,*

1. Introduction

The sun produces radiation at many different wavelengths and wavelength classifies the measure of how energetic is the radiation. Especially ultraviolet radiation in biological band, UV-B radiation (280-315nm) is more prominent because of its adverse effects on human, plant and other beings. The most important factors affecting the incoming UV radiation reaching the earth's surface is the total amount of ozone that solar radiation encounters before reaching the earth's surface and is commonly referred to as column ozone. It is the total amount of ozone in a column between the earth's surface and the top of the stratosphere. This is expressed in Dobson Units (DU). Hence a decrease in stratospheric ozone will result in increase in UV-B radiation. As per WHO (World Health Organization) UV-B radiation is measured in terms of parameter known as UV Index whose value denote the impact of radiation. It is shown in Table 1.

S. No	UV Index	Risk
1	1 to 2	Minimum
2	3 to 4	Low
3	5 to 6	Moderate
4	7 to 9	High
5	10 and above	Very High

Table 1: Table showing Risk vs. UV Index as per WHO

The present study is aimed to analyze the change in UV Index over this decade in Bangalore and its dependence on column ozone (TOC) received during 2006-2015.

2. Data

UVIdatausedinthestudyareobtainedfromTroposphericEmissionMonitoringInternetService (TEMIS)http://www.temis.nl/ and the TOC data are obtained from NASA's Ozone Monitoring Instrument (OMI)http://www.aura.gsfc.nasa.gov/instruments/omi.html.From the daily values monthly averages and annual averages are derived for this station.

3. Results and Discussion

3.1. Long Term Variation of TOC and UVI

The data obtained for TOC and UVI was segregated into monthly means from 2006 to 2015 and is presented.

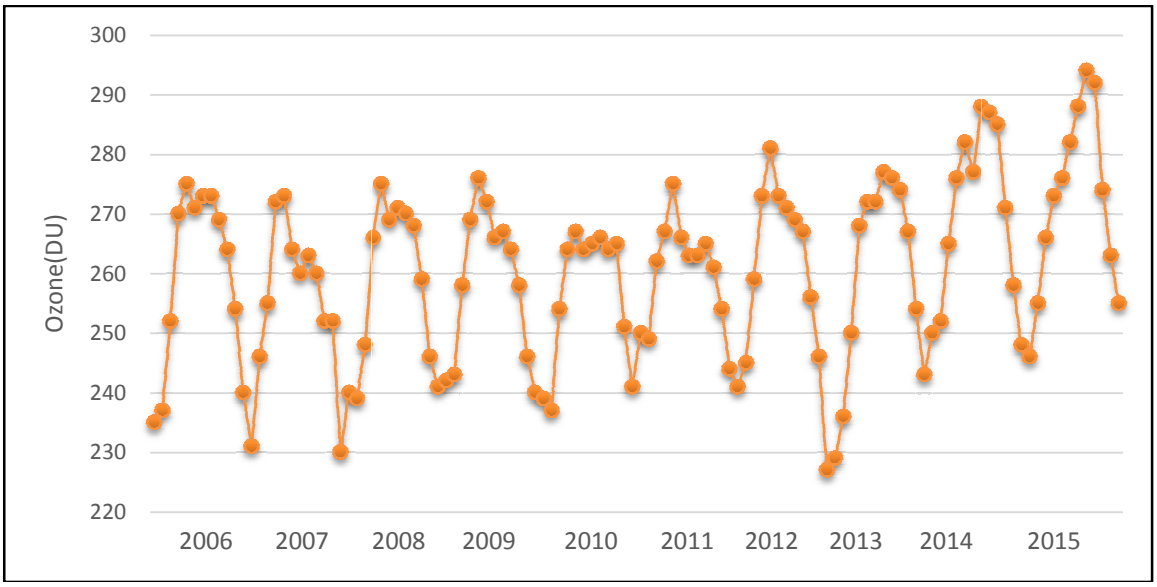

Figure 1: Long term variation of Ozone (2006-2015)

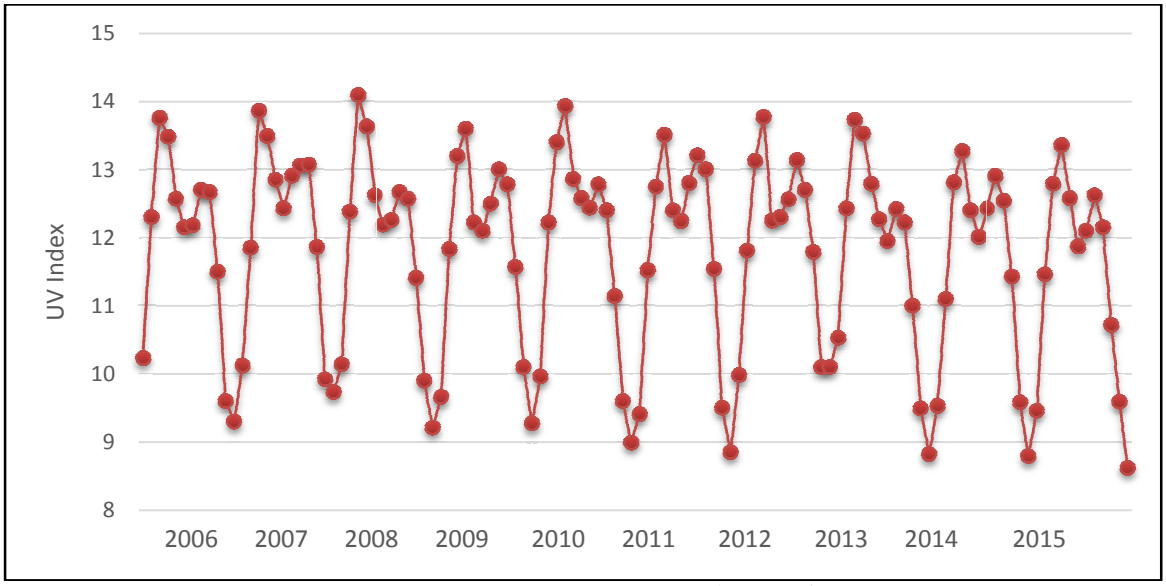

Figure 2: Long term variation of UV Index (2006-2015)

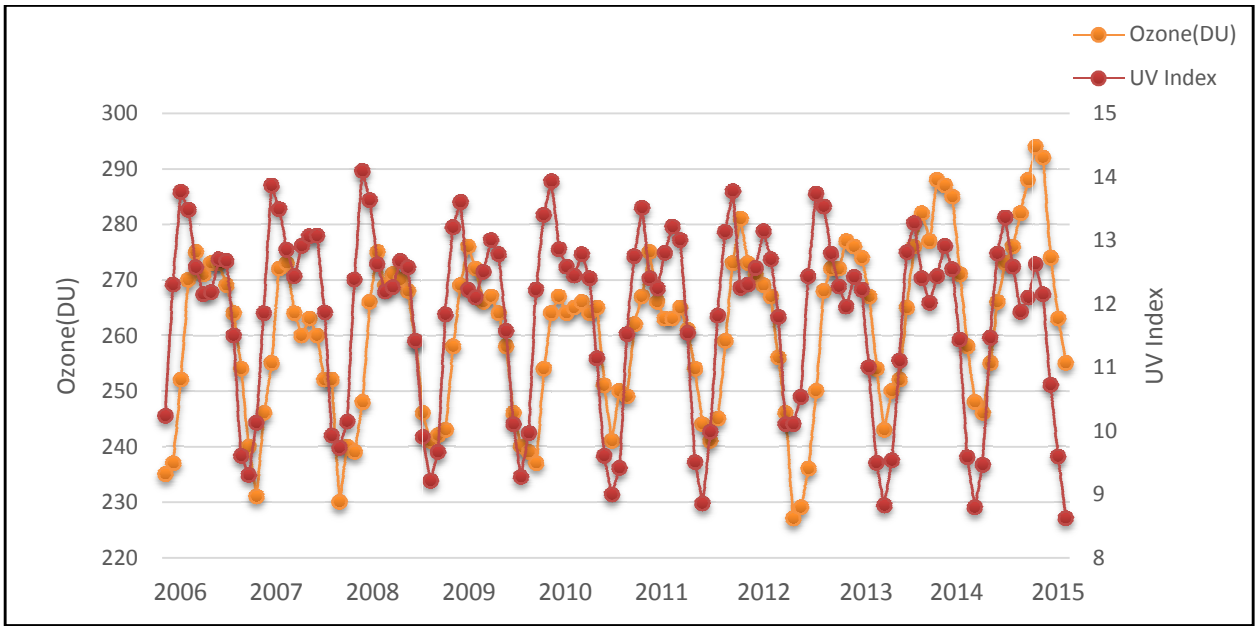

Figure 3: Long term variation of Ozone and UVIndex(2006-2015)

Figures 1,2,3 indicate the variation in mean values of TOC and UVI for Bangalore. From the above analysis it is clear that mean average UV index decreases from 2006-2015. This decrease in UV radiation is due to the increase intotal ozone. The UV Index is found to increase from 13.4 to 9.15 for a corresponding increase in ozone from 237 to 278Dobson Units. This change in UV Index corresponding o change in ozone indicate almost a decrease of 1 unit UV index from every increase in 10 Dobson Units of ozone for Bangalore. K. Elampari et.al.,2013 has reported almost a change of 43 DU with UVIndex falling half to its value from 10.65 to 4.6 for the period 2006-2010 for different Indian stationsi.e. for every increase in 7 Dobson Units of ozone a decrease of 1 unit UV index. This might be due to local conditions that affect UV radiation indirectly apart from decrease in ozone.

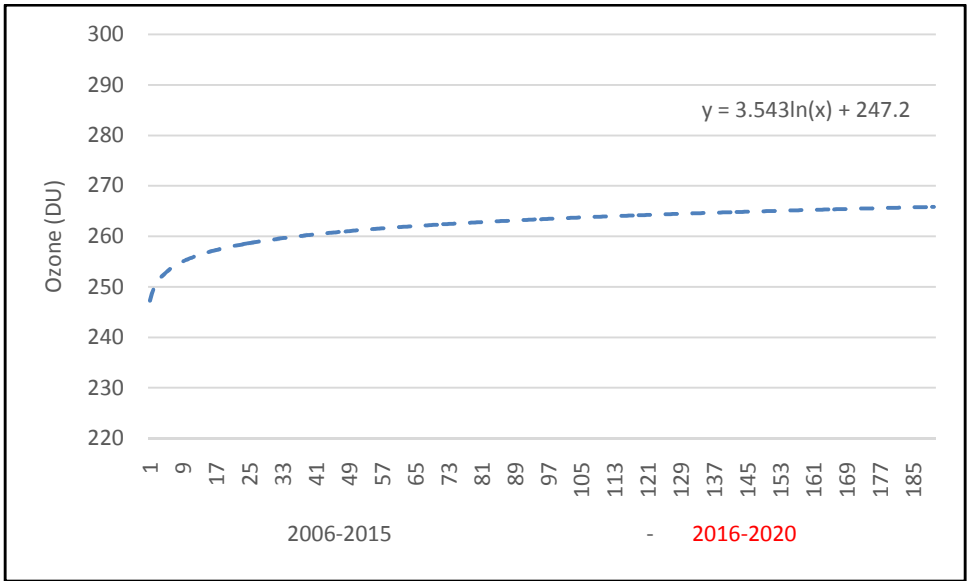

Figure 4: Extrapolated variation of Ozone (2006-2020)

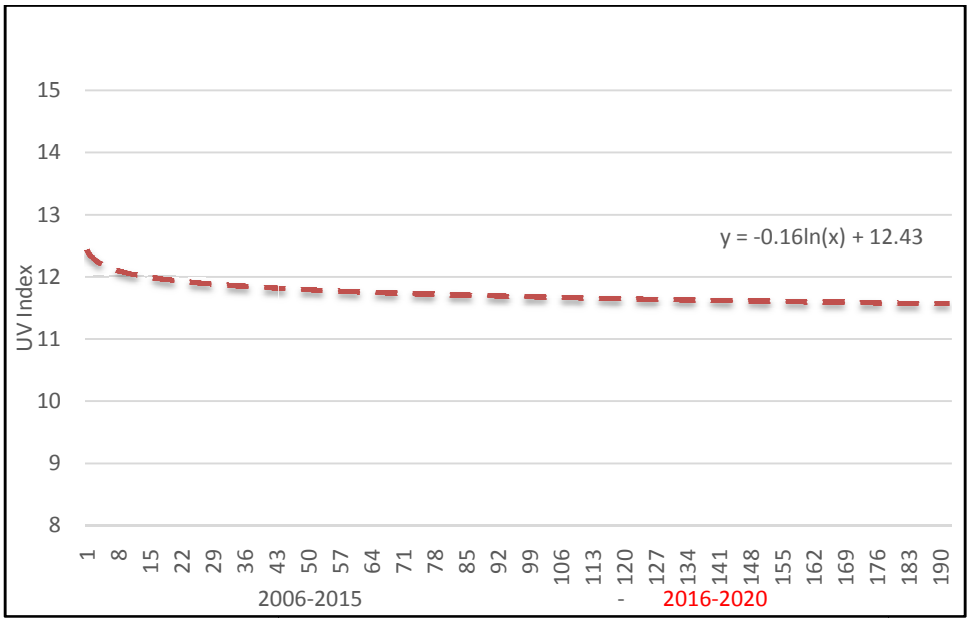

Figure 5: Extrapolated variation of UV Index (2006-2020)

Figures 4 & 5 show extrapolation of ozone and UV index upto year 2020. Both the graphs show a flat trend for the years 2016 to 2020. As shown in the graphs points 1 to 120 on x-axis represent monthly means from 2006 to 2016 beyond which the points represent extrapolated values of ozone and UV index for 2016 to 2020. The graphs show a flat trend with small increase in ozone and decrease in UV index.

3.2. Seasonal Variation of Ozone and UV Index

Data obtained for TOC and UVIndex for Bangalore during the period 2006-2015 was analyzed and it was observed as shown.

S. No	Year	Winter		Summer		Monsoon	
		Ozone	UVI	Ozone	UVI	Ozone	UVI
1	2006	241	10.35	267	12.99	270	12.26
2	2015	255	12.65	274	9.78	287	11.89

Table 2

These analyses indicate the seasonal variation in ozone and UV index for two years 2006 and 2015. It is clear that the amount of ozone concentration goes on increasing from winter to monsoon. However, the corresponding UV index is not found to be decreasing. This clearly indicates that the incoming solar ultraviolet radiation is not purely dependent on ozone concentration itself. It is influenced by other parameters like solar zenith angle, latitude and local anthropogenic conditions etc. As per the weather data the no of days with rainfall is 100+ on average every year. This might be one of the reasons why uv index is not decreasing exponentially with corresponding increase in ozone.

5. Conclusions

The relationship between UV-Bradiation and Total ozone content for Bangalore has been analyzed in the study. The results indicate that the variation in UV index is not purely dependent on total ozone only. The UV index levels received by Bangalore are indicating High Risk which should be addressed immediately.

6. References

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