

LONG TERM TREND ANALYSIS OF TOTAL COLUMNAR OZONE OVER INDO-GANGETIC PLAINS (FROM 2005-2013) & ITS ASSOCIATION WITH ANTHROPOGENIC ACTIVITIES

Rashmi Hazarika¹, Dr. Anu Rani Sharma²

¹Student, TERI University

²Faculty, TERI University

TERI University, Vasant Kunj 10, New Delhi.

Abstract

Ozone (O₃) layer is considered as an important atmospheric constituent as it absorbs the harmful UV radiation of sun at stratospheric level. But, when we talk about formation of ozone at tropospheric level, it is considered as one of the secondary pollutants which causes adverse effect on human health, vegetation and earth's atmospheric condition.

This study is carried out to analyze the long term trend of tropospheric ozone over Indo Gangetic plain (2005-2012) & to assess the source attributes of ozone.

Dataset used for this study are yearly averaged ozone data of OMI (aura) satellite. Hot Spot analysis of data for each year has been done to find out the hot spots i.e. the regions where the concentration of ozone is high and where it is relatively low. In order to assess the source attributes of ozone, satellite derived dataset of NO₂ (nitrogen dioxide) is used and various statistical methods (line graphs) are used to find out the relationship between NO₂ concentration and Ozone level. Further, ground dataset of thermal power plants have been used to assess the association of anthropogenic activities with increasing ozone level i.e. emission of SO₂, CO₂ & NO₂ emitted by these power plants are compared with the ozone data to find out whether there is any correlation between it or not.

About the Author



Ms. Rashmi Hazarika
MSc Geoinformatics

Student of TERI University, New Delhi, pursuing my MSc in Geoinformatics. I have actively participated and presented poster in various symposium and workshops related to Remote Sensing & GIS. I have also done an internship of two months duration at North East space application center, Umiam.

E mail ID: hzrk.rashmi9613@gmail.com,

Contact No: +91 – 9560514553

Introduction

Tropospheric ozone is one of the important components in the atmosphere and it plays a vital role in the environment, earth's atmospheric, and climate change over a region.

As we know that photo-dissociation of NO₂ with other gases and solar radiation leads to formation of tropospheric ozone, which is hazardous to human health like respiratory diseases, skin cancer, etc. and also cause global warming.

In this study, OMI data of Ozone and NO₂ (2005-2012) have been studied and with the help of Arc GIS, hot spot analysis is carried out to find out the hot spots of tropospheric ozone. From our analysis it is being found that there is higher correlation between increasing level of NO₂ in the atmosphere with the level of tropospheric ozone. Also, CO₂, SO₂ & NO₂ emission data of 4 thermal power plants of IGP region (2009-2010) have been analyzed and from the study we can say that with the increasing emission of these gases over the year, the level of tropospheric ozone is also increasing.

Location of study area

The study area covers the Indo Gangetic plain of Indian which is known for major industrial and agricultural development. It covers from Punjab to west-Bengal.

Methodology

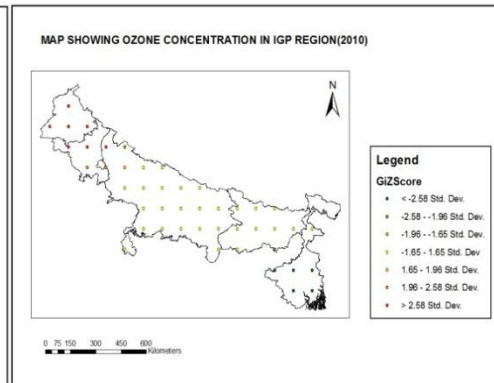
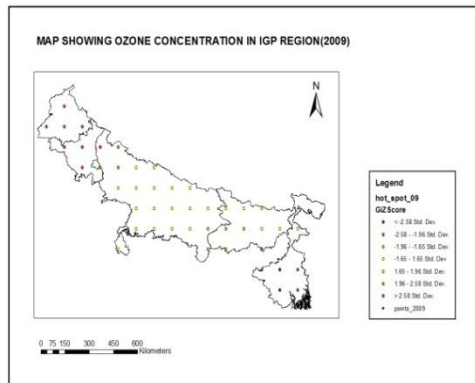
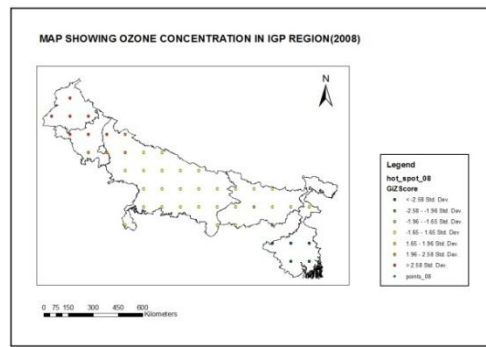
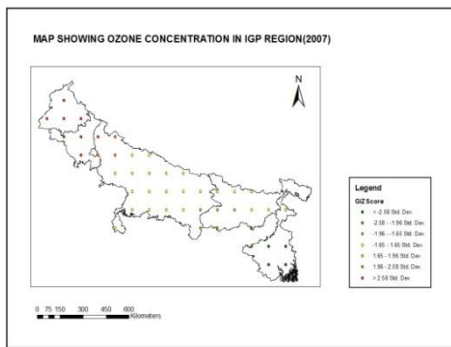
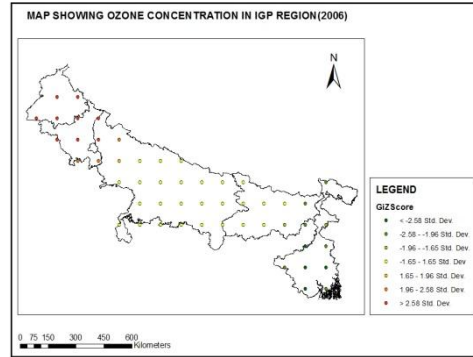
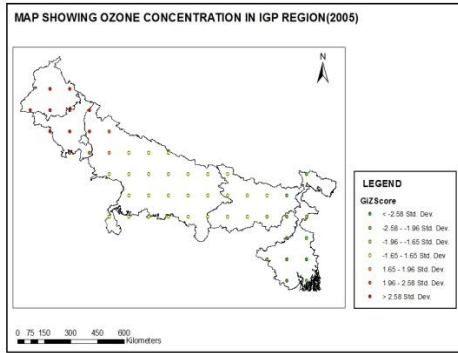
The methodology followed in this study is as follows:

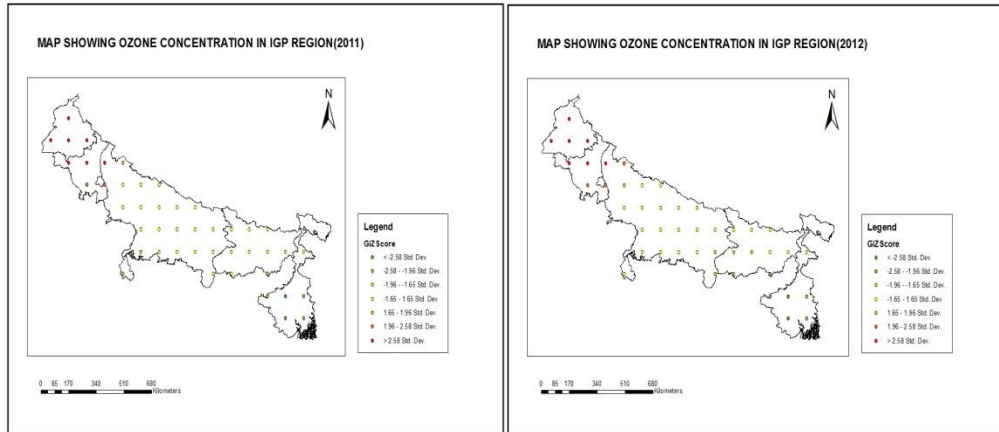
1. With the help of Arc GIS, hot spot analysis of yearly ozone data from (2005-2012) has been done and it is found that the trend of tropospheric ozone is increasing over the period of 8 years and the level of ozone is high in the state of Punjab and Haryana as compared to the state of West-Bengal.
2. Monthly averaged ozone data is being compared with the monthly averaged NO₂ data by plotting the data in line graph. And from our study, it is found that there is higher correlation between increasing level of NO₂ & ozone.
3. Also, graph of emission of data of CO₂, NO₂, SO₂ from 4 thermal power plants of (2009-2010) are compared with the yearly ozone data of (2009-2010) respectively and we have found high correlation between these gases and increasing level of ozone in atmosphere.

Results and Discussion

The hot spot analysis of tropospheric ozone from the period of 2005-2012 gives the result that the state of Punjab and Haryana have higher concentration of tropospheric ozone whereas the state of U.P. and Bihar have moderately less concentration and West Bengal has relatively low concentration of ozone as compared to other states of IGP region. It is being also seen from the analysis that from the year of 2007 to 2012, the concentration of tropospheric ozone has increased over the state of U.P. and Bihar as compared to past two years.

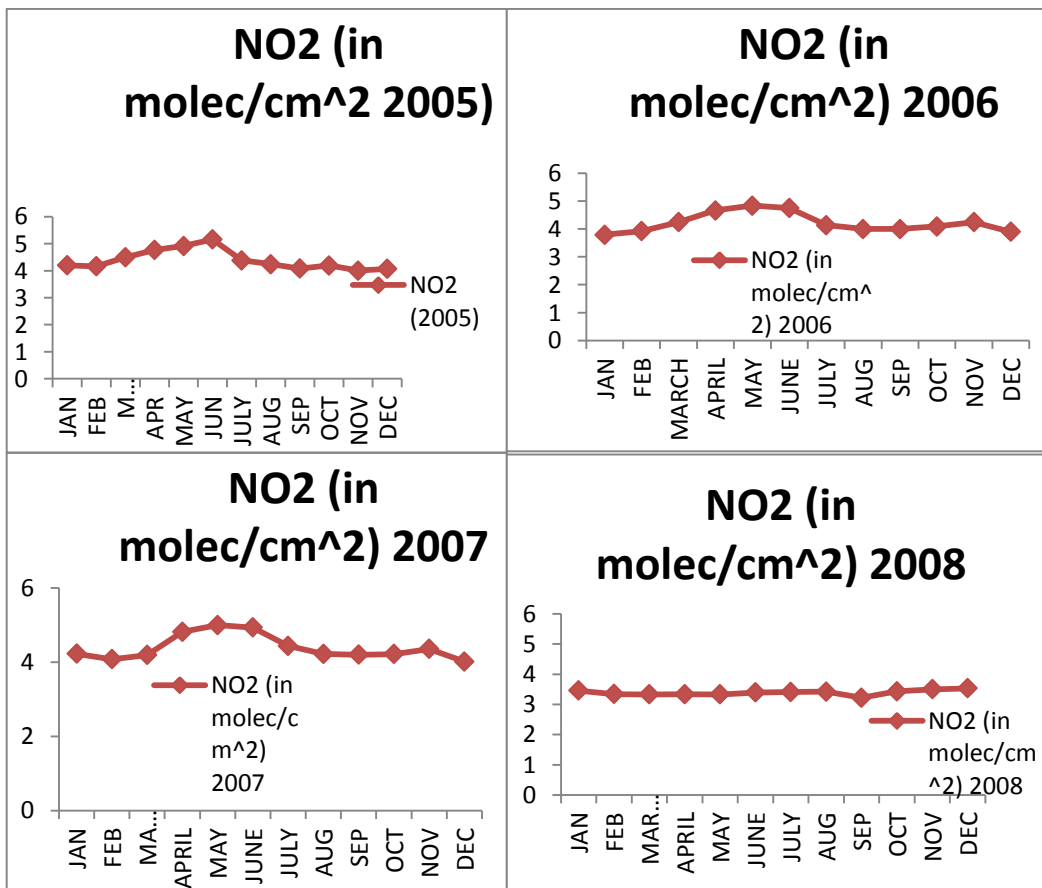
Given below are the maps of hot spot analysis of IGP region from (2005-2012).

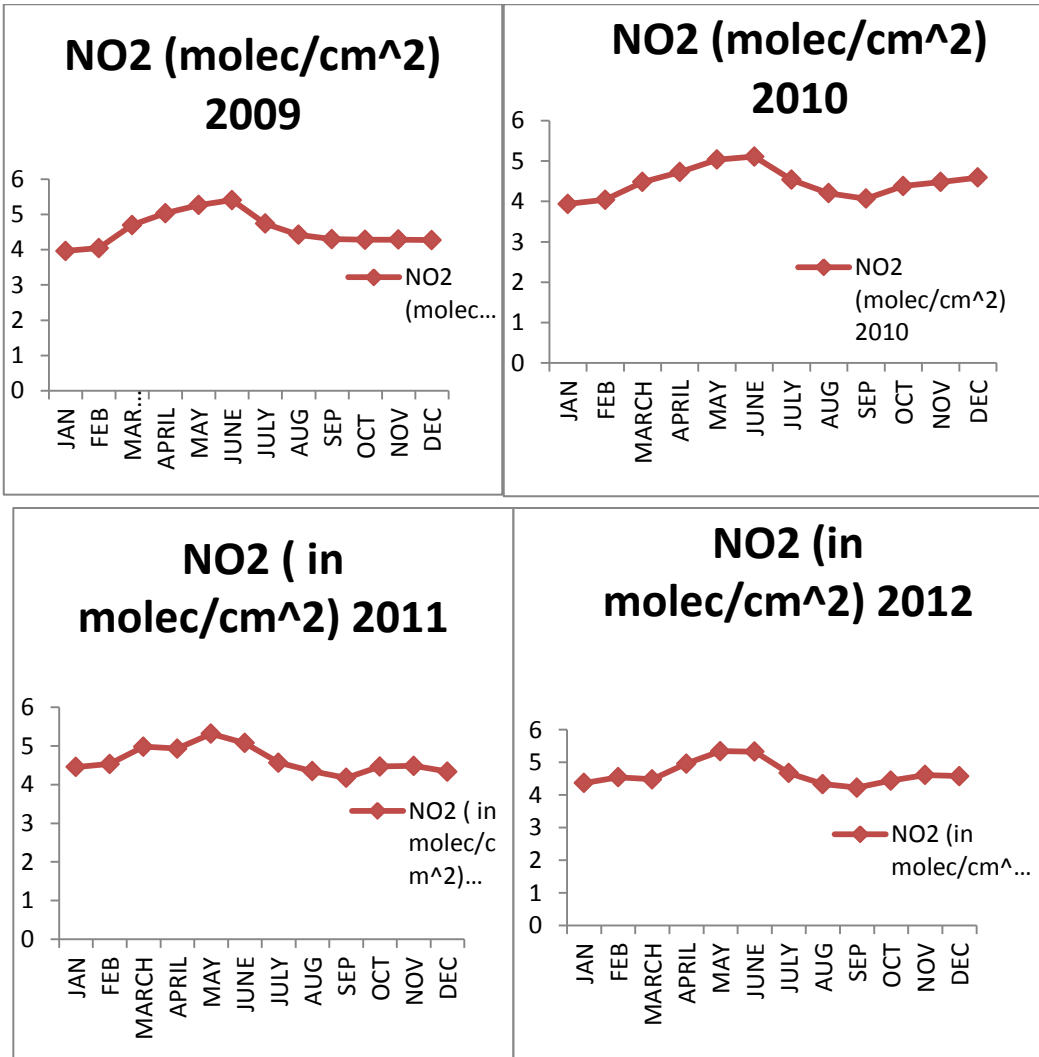


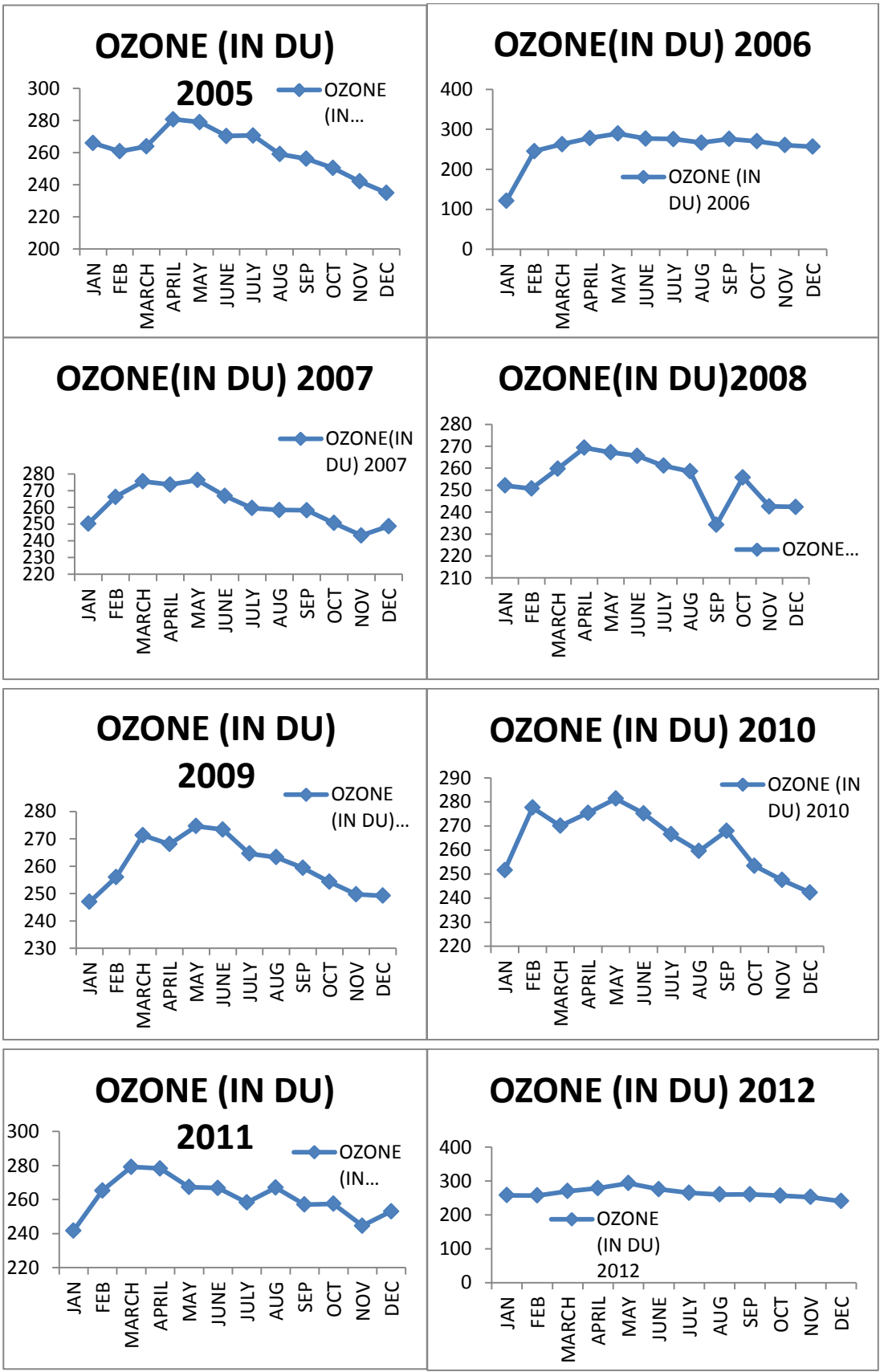


Given below are the graphs of monthly averaged NO₂ and Ozone data from the period of (2005-2012). The graphs show that there is higher correlation between NO₂ and Ozone data.

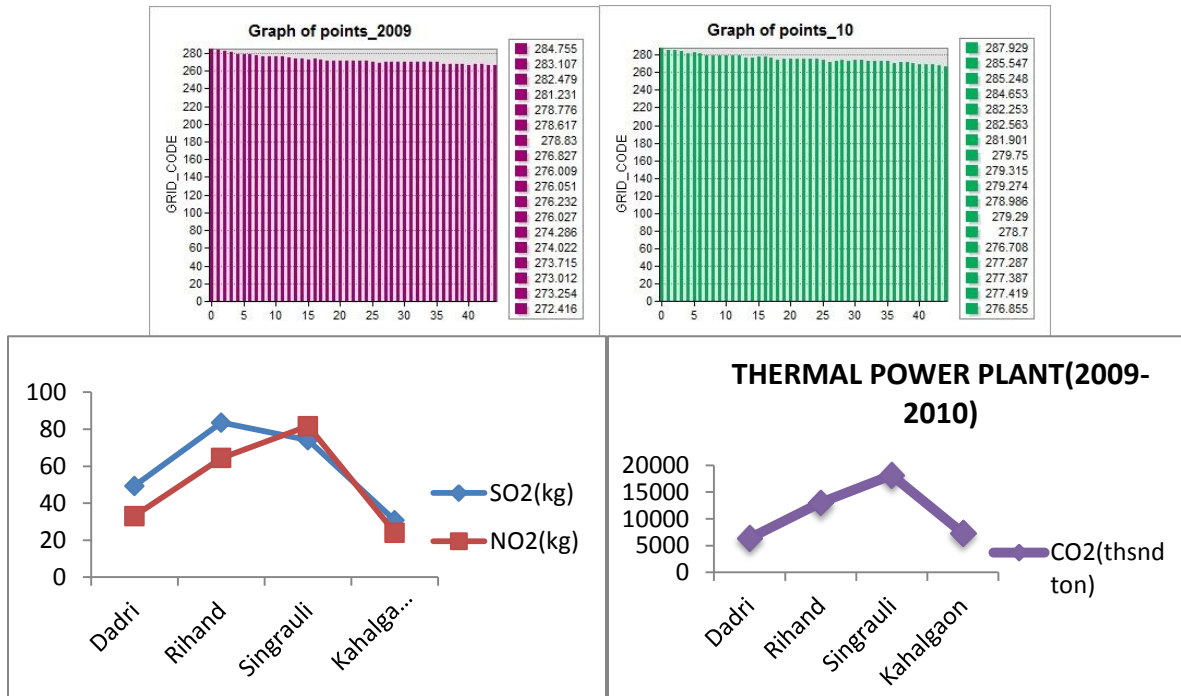
It can be also seen from the given figures that concentration of Ozone is relatively high in the months of April to May whereas it is low in the months of January to March and gradually decreases after the month of June. Same is with NO₂ concentration which is comparatively high in the months of April and May and decreases after June. So, here we can conclude that with the increasing level of NO₂ in atmosphere, the level of tropospheric Ozone is also increasing.







Yearly Ozone data from (2009-2010) is being compared with thermal power plant emission data of CO₂, SO₂ and NO₂. From the graphs below we can see that emission of these gases is relatively high in the IGP region and so is the concentration of Ozone.



Conclusion

From this study it can be concluded that the Indo Gangetic plain has higher level of tropospheric ozone and its concentration is increasing over the years. With the comparative study of ozone data with NO₂, CO₂ and SO₂ data, we can reach to this conclusion that with the increase of anthropogenic activities like- emission of harmful gases, power plants, vehicles, industries, etc. have played a key role in increasing the level of tropospheric Ozone.

References

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2. IPCC: Climate change 2007 – Synthesis Report, 2007.