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Case Study of Diurnal Temperature Changes Caused by Anthropogenic Activity Using Meteorological Data in Coimbatore District

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ABSTRACT

A case study was carried out to measure the Diurnal Temperature Changes in Coimbatore caused by anthropogenic activities which are victims of climatic changes. Temperature information is analyzed which serves as a tool for verification while using remote sensing methods. As a cause of pollution in metropolitan cities, increasing temperature in different time periods are observed. Thermal changes are recorded, also owing to the daily fluctuations in Carbon monoxide emission which affects the atmosphere. A study on the environment of Coimbatore reveals that the temperature is comparatively cooler with respect to the past days and this paper reveals the impact of temperature in the environment. Factors such as variations within the region composition plays a vital role in temperature changes. This paper focus on how surface temperature affects the daily temperature cycle in Coimbatore. This paper concludes that surface temperature rises whereas daily temperature fluctuation causes in decreases temperature.

Keywords: Climate diurnal change; Carbon monoxide change; predicting increasing Temperature

1. INTRODUCTION

Remote sensing has been used in measuring temperature and climatic changes coverages for years. In recent times, Waste particles emission from industrial and incineration to the atmosphere serve as the primary causes of pollution alongside the main contributor of air pollution, which is vehicular emission[1]. A recent study revealed that Coimbatore, Chennai, Salem and Tuticorin shows high air pollution rates in comparison with the list of urban cities .Coimbatore is said to be the Manchester of Tamil Nadu with large number of industries[1]. The ambient air quality of Coimbatore has become progressively worse with an increase in the number of vehicles and advent of industrialization. On an averages it is estimated that nitrogen oxide emission is less compared to that of carbon monoxide. Evaluation of traffic pollution in roadside needs three basic factors: Roadside pollution emission, climatic conditions, and the atmospheric surroundings[1]. Exploring the connection between model predictions and analyzing with respect to the barometric conditions and interconnection between various pollution components provide significant evaluation of the traffic pollution exhaust in atmosphere[2].

Determining the temperature of diurnal data as daily weather data, the annual temperature variations changes in the vegetation index of Coimbatore District [2].

2. MATERIAL

The reasons for studying calculating and measuring carbon monoxide gases in atmosphere. The data in NASA earth observation satellite shows the required information about Coimbatore region and further able to predict the temperature, increasing in future.

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2.1. Study Area

Coimbatore district is situated in the western part of Tamil Nadu, surrounded by the state of Kerala and Karnataka. It is lies in between the Western Ghats mountain range on its surroundings of south west regions. The Noyyal River runs in to Coimbatore and agriculture to the southern boundary of the city limits. Coimbatore lies in the latitude of 11.0168 °N and longitude of 76.9558 °E, It had a population of 3,458,045 in 2011 census. The district had 958,035 of domiciliary during that time. Coimbatore district is divided into revenue part in mapping as Coimbatore and Pollachi, with their 10 taluks.

2.2. Dataset

NASA Earth observation satellite System is coordinated series of orbiting on Polar region and inclination angle in that satellites for long term process in observation of the surface area, atmosphere condition and oceans temperature. NASA Earth observation Satellite is a part of the Earth Science division of NASA Science Mission.

The concentrated carbon monoxide in Earth atmosphere had been increasing because of the anthropogenic activities. As shown, current surfaces measurements reveal that leveling off of the carbon monoxide gases are concentrated .The full ranges of the effects of increased concentrations of carbon monoxide is photo chemically active which shows that concentration of OH Radical in the atmosphere. Increasing carbon monoxide may resources of tropospheric OH Radicals there by reducing the yearly decreasing lot of atmosphere natural resources and human made species. This affects increase in methane levels in the atmosphere, which in turn further reduces OH concentration. Increasing carbon monoxide may also inversely affect global warming and the stratospheric ozone layers by increasing the life time on finding gases like methane and chlorofluorocarbons (CFCs) [3]. Global measurement of carbon monoxide and methane (also measurement by MOPITT) will certainly shed light on concentration on OH ,which is one of the most important and difficult species to measures in atmosphere because of the very low concentration. As the measurement will interact with the surface, ocean, land and the carbon cycle.

Terra provides information about Earth atmosphere and geochemical energy system using different sensors that observe the atmosphere, land cover, oceans, snow, ice and energy of the atmosphere [3]. Sensor has unique features that enables researches in various regions of the earth. There are five different type of onboard sensor is used as

1. Advanced Space borne Thermal Emission Reflection Radiometer-ASTER
2. Cloud Earth Radiant Energy System-CERES
3. Multi Angle Imaging Spectro Radiometer-MISR
4. Moderate-Resolution Imaging Spectro radiometer-MODIS
5. Measurement Of pollution in the Troposphere-MOPIIT

Measurement Of Pollution in the Troposphere measuring the data of global carbon monoxide and other polluted gases which may also be used for parallel modeling to study the effects of atmospheric changes, vegetation difference and global tropospheric changes .The MOPITT Level-2 carbon monoxide Data is geographical located and retrieved on carbon monoxide profiles and maximum in ranges of carbon monoxide and methane. The horizontal footprint of each data retrieval is 22 kilometers to 22 kilometers per square areas [3]. Also data concerning land surface properties and atmospheric correction on each location .MOPITT geographical physical parameters are obtained from the level 1-B radiances in joining with necessary support for global earth distribution of land and atmospheric temperature control and humidity measurement.

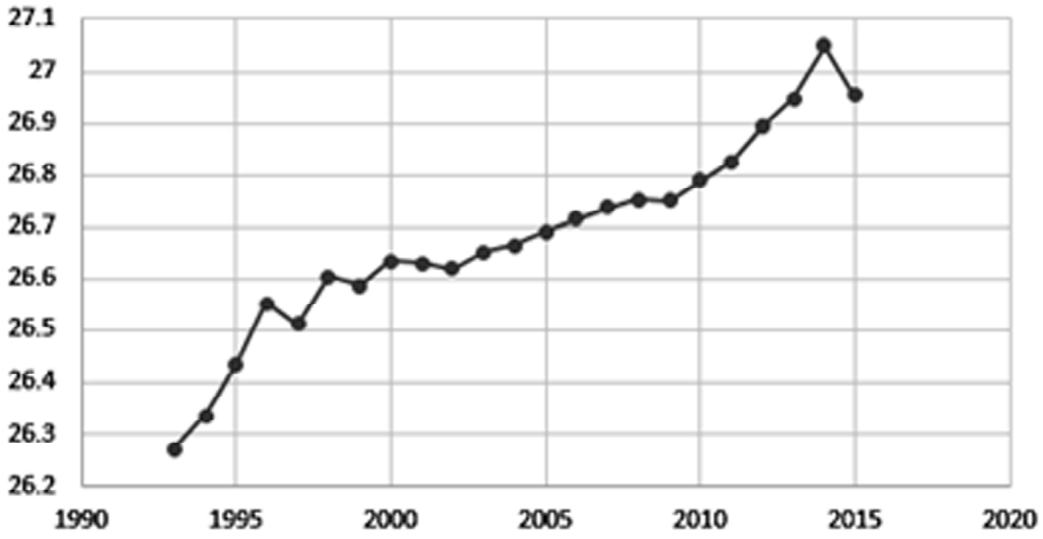

Figure 1: Representing Temperature changes in Coimbatore

Radiance evaluation 4.7-micrometer CO band produce the primary information in the vertical CO blended to the part of ratio profile in the topper layer troposphere [4].

Total column very large quantity of carbon monoxide and methane are derived primarily using measurements of reflected solar radiation in 2 bands approximately 2.3 micrometers, and the best are obtained, occurring in sunlit portions of the orbits [4]. Clouds have a features of a large capacity on the gained radiances and their effects must be model suitably to get obtained algorithms

3. METHODS

Coimbatore has ambient climate, because it is surrounded by thick forest, mountain ranges. The cool airflow blowing through the Palghat district makes the temperature consistently pleasant. The city has a tropical wet and dry climate, with the wet season lasting from October to December due to northeast monsoon.

In this paper, the diurnal climate changes of Coimbatore measures that 0.6 °Celsius increased Within 10 years and the climate changes problem on metro cities which causes maximum temperature in Coimbatore district of 39 °Celsius but before 10 years the maximum temperature in Coimbatore was 35 °Celsius which is approximately 3-4 °C difference .

As considered the minimum temperature was 17 °Celsius before and its 19 °Celsius at present which gets reduced into 2-3 °Celsius in range. This causes increasing in temperature level and decrease in temperature due to pollution in the atmosphere.

In this paper, it is shown that temperature level increases and the amount of increasing the temperature from carbon monoxide gases is based on Remote sensing methods. The maximum temperature occurred in Coimbatore district on March 21 is of 39 °Celsius, In a Day maximum temperature is 35 °Celsius and the maximum temperature may exceeds up to 37 °Celsius. On a analyzing, it is inferred that April is the hottest month on comparing averages of Maximum temperature of 36 °Celsius.

Comparing the averages of maximum temperature, the maximum temperature in a day was September 4 .The maximum temperature on that day was calculated to be 35 ° Celsius, on analyzing to average of 31 °Celsius, if compared those two temperature a mean value of 31 °Celsius which is compared to temperature difference of 4 °Celsius.

In relative terms, the hottest month is March, with a mean value of maximum temperature of 36 °Celsius compared to the mean value of typical values 35 °Celsius .

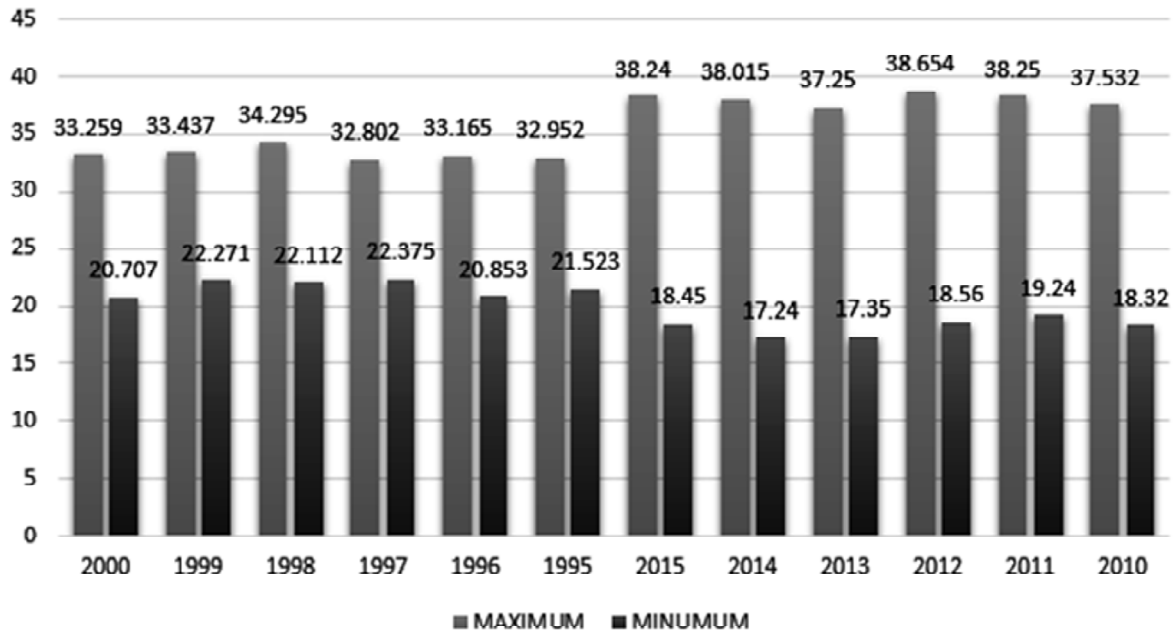

Figure 2: Represent five year of comparison maximum and minimum temperature changes in Coimbatore

The lengthy warm days is march 8 to April 9 ,establishing 33 daily bases days with maximum temperature than the Mean value of maximum temperature .The month of March has the largest part of warmer days than average days with 94 percentage days higher than average temperature.

The minimum temperature occurred in January 3, with a minimum temperature of 17 °Celsius on the day with average minimum temperature of 21 °Celsius and the minimum temperature dropped below up to 19 °Celsius [4].

The coldest month in measuring is January with a Mean value of daily minimum temperature of 21 °Celsius. In relating to the remaining days, the coldest day is April 25, the minimum temperature during April 25 is 21 °Celsius, on comparing to previous years the average minimum temperature is 25 °Celsius showing the difference of minimum temperature to be 4 °Celsius.

In relative terms the coldest month is January, with an average minimum temperature of 24 °Celsius, this shows that compared to a typical value of 25 °Celsius [4]. The lengthy cold spell is from May 11 to May 19, establishing 9 consecutive days with cooler than average minimum temperature. The month of May had the largest fraction of cooler than average days with 61 percentage days lower than average minimum temperatures.

3.1. Carbon monoxide affects

In 1990, As NASA Earth observation satellites images shows that amount of carbon monoxides gases in Southern India is comparatively lesser than that observed from 2015 Satellite images [5]. This shows that level of carbon monoxides gases is increasing on a yearly basis which is a primary cause for climate changes on increasing diurnal temperature changes in Coimbatore which increase up to 0.6-0.7 °Celsius.

3.2. Predicts temperature increases

As shown in fig 1, temperature value gradually increase in Coimbatore and may serve as a cause that aid with an increase in carbon monoxides level [6]. This paper shows that the rate of carbon monoxide gases in 1992 is neutral and it predicts temperature and carbon monoxide increasing level up to the year 2015, in which the level of increase is 2×10^{-5} per volume

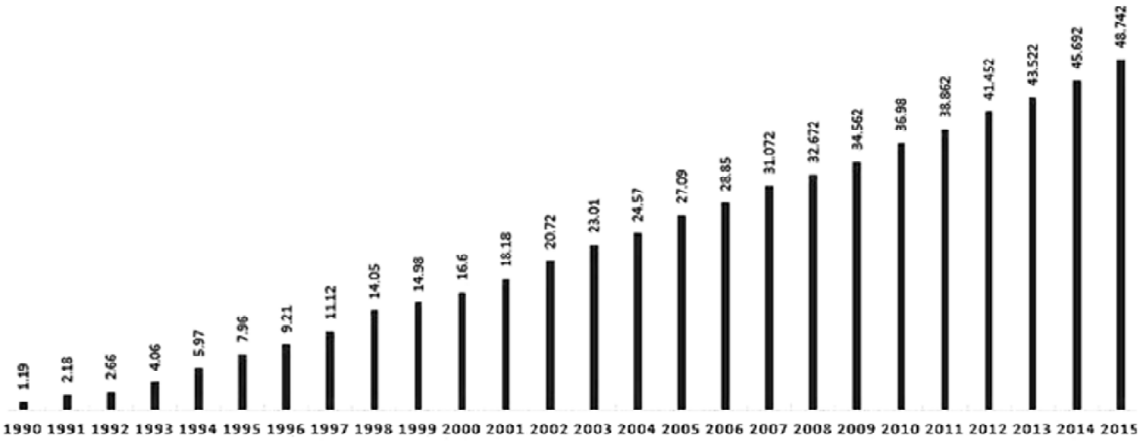

Figure 3: Carbon monoxides level increasing in Coimbatore

Carbon monoxide level in Coimbatore in 1990 was 265.35ppm, from where it gradually increased up to the level of 48.742 ppm in 2015 [6]. On comparison to carbon monoxide gases and diurnal temperature increases predicting the temperature will be increasing to a maximum of 1.2-1.5 °Celsius in Coimbatore.

An equation which is correlating to carbon monoxide and diurnal temperature in presences of maximum temperature is showed and given an impact of general correlation equation to find the maximum temperature cause and predict temperature increase onto 1.2-1.5 °Celsius [6].

4. METHODOLOGY

Correlation is one of the most commonly used descriptive statistics because they are relatively simple to compute and the result is even easier to understand [7]. By calculating the Predicting temperature shown up to 2016 and to 2020 the temperature level raises if the increasing carbon monoxide gases are increasing maximum 350 ppm ,then the temperature will increase[7]. On description, the linear relationship between two matrix which are both a vector affected by outliers. It always plot data in excel before interpreting, so carbon monoxide as a vector and increasing temperature as a vector coefficient and correlation of both the vectors by using of given equation [8].

$$y = mx + b \tag{1}$$

In this equation (1) *x* and *y* are the independent variable and this equation to find the linear coefficient.

$$\hat{y}_i = a + bx_i \tag{2}$$

The equation (2) shows that the similarity if the equation find actual vector of the given data to find the predicting data sources

$$e_i = y_i - \hat{y}_i = y_i - \left(a + bx_i\right) \tag{3}$$

The equation (3) shows that the covariance and correlation of the two variables are to find out prediction on covariance of vector *y* and finding values of the coefficient *x*. The equation (3) tell about the computation analysis in predicting temperature by using of two vector in carbon monoxide gases as on vector and temperature increasing as vector predicting by covariance value *r* for each data point as increasing temperature and signification of increasing temperature lies in vector for the given data.

5. RESULTS

Regarding Diurnal temperature changes, the calculation of mean and average value for each and every day is determined Figure (1) represents standard deviation of each days and month calculated to find increasing

Table 1
Predicting Temperature And Its Difference

Year	*Temperature*	*Difference*
2020	27.302	0.02199
2019	27.28	0.0270005
2018	27.253	0.017907
2017	27.2351	0.0420990
2016	27.193	0.240082
2015	26.95292	-0.09697

temperature of the Coimbatore. By using the same data in that each days has separated into four different category as mild, warm, hot and warm as regarding separation we are able to determine maximum and minimum range for an year, using of NEO data in spread sheet to determine location for Coimbatore, finding standard deviation of the spread sheet and to measure the increasing carbon monoxide data level in region finally predicting value for the increasing temperature in covariance of two vector shows in that equation (3) which is able to predict temperature increase by deriving an equation which shows the increasing in temperature of Coimbatore district.

6. CONCLUSION

The result shows that predicting temperature increases up to the level of 0.5-0.6 °Celsius (2016-2020) temperature using method of correlation on carbon monoxide data and diurnal temperature data for finding an actual equation in increasing on yearly basis. Fig 4 represent that the Maximum temperature is observed in the summer season and minimum temperature level is studied in winter season of the region. In case of carbon monoxide gases in temperature which get increases diurnal temperature is calculated using computational methods and linear regression method to find predicting temperature changes in Coimbatore district.

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