

## **Impact of Global Warming, Climate Change in Kolkata- the Important Metropolis of India.**

**Dr Manasi De**

*Associate Professor & Head Department of Geography Lady Brabourne College. Kolkata. W.B. India*

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**Abstract:** Global warming is the most serious environmental problem of the earth in the recent period. Global cooling and warming both are the two natural processes of the earth. Apart from the natural processes global warming is also caused by the anthropogenic activities. We are passing through an interglacial period. Ever increasing trend of global atmospheric temperature has started after Industrial Revolution. The recent warming of earth is associated with the accelerated rate of human intervention into the nature. This is become serious concern for the existence of the biodiversity and the human society on the earth. The anthropogenic activities which are considered as responsible for the gradual deterioration of the environmental qualities are - emission of green house gases at an alarming rate which has gradually change the atmospheric chemistry, deforestation, implementation of faulty reforestation and afforestation programmes, industrialisation, haphazard growth of new towns and expansion of urban areas, encroachment of the wetlands, changes of the land use pattern, increasing rate of the use of air conditioners, refrigerators, automobiles, etc. Unwise intervention into the nature creates a critical condition into the nature to maintain the ecological balance of the environment. The probable result of which is global warming. Warming of the earth introduces different environmental problems. Most important of which is Climate Change at local, regional and global scale. Kolkata is one of the important cities of India since the British Period. The City was the capital of India in the British period due to its convenient location and good communication net work. At present the city covers only 185 sq. Km area. That provides shelter to more than 4.48 million people in recent time. The physical set-up of the city has been disturbed with the alarming rate of anthropogenic intervention into the nature. High-rise buildings are growing here and there at the cost of green open spaces, water bodies, and the plants. The concrete jungle helps to increase thermal pollution of the city. There are more than 80,000 industrial units are operating in the city. Which deteriorate the quality of the environment. Increasing automobiles are the other indicators of the warming of the city- atmosphere by the emission of huge amount of Green House Gases in the air. Density of population of Kolkata is 24,306 persons/sq. km in 2011. Transport connection is conducive to the high density of population in Kolkata. Nearly one lakh people are commuting regularly at Kolkata for their livelihood. The city is overcrowded with the natural growth and the immigration.

Temperature records have to be considered as the primary indices of the global warming and the climate change. Kolkata is facing the problems of global warming and climate change. There is a sharp increase of the atmospheric temperature. And the city is gradually becoming a heat island. Future generation will be sufferer by the unwanted alteration of the environment of Kolkata.

**Objective:** The objective of the work is to find out the nature of warming and the resultant effects of the climate change of Kolkata, one of the important metropolises of India.

**Methodology:** 1.The secondary data was collected from India Meteorological Department, Regional office, Kolkata, Kolkata Municipal Corporation, Forest Department, Department of Wetland Management, Government of India. 2. Computation and diagrammatic representation of the data. 3. Consultation of Books, journals 4.Aanalysis

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### **I. INTRODUCTION:**

According to the World Climatologists the overall increase of the global temperature in the recent period (after 1860 A.D) is 0.5 to 0.7 degree centigrade. That was calculated from the systematic recording of air temperature at different meteorological centres of the world which was started from 1880. 20<sup>th</sup> century was the warmest century in the last 200 years and the last two decades of which e.g. 1980s and 1990s were the warmest decades of that century. In the geological past climate has changed in several times by natural causes. The last ice age in the northern hemisphere which was identified as **Little Ice Age** (from 1450- 1880) was witnessed by the middle and high latitudes. This ice age was extended more than 400years. Climate of that period was severe to live in the higher latitudes. Temperature of Greenland became far below the freezing point. Settlements and the other infrastructure of these areas were under the deep cover of ice sheets. People were either shifted from the land or perished by the severe coldness. Alpine glaciers were more active, rivers, lakes were frozen and

human death was occurred by severe famines. After that the global temperature is its ever increasing trend in both the hemispheres (Singh)

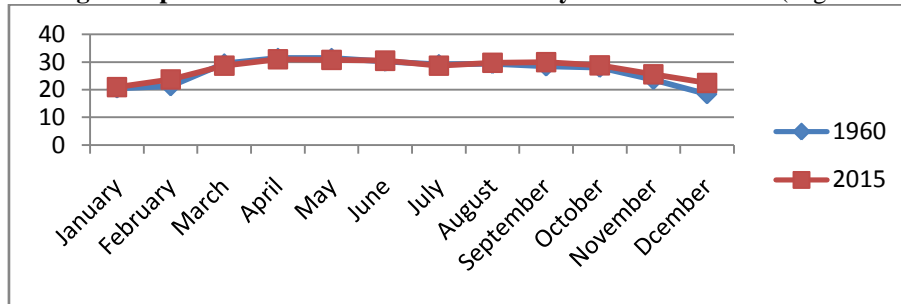
**Climatic Condition of Kolkata:**

Kolkata is characterised by the hot and humid climate. It is located into the Tropical Monsoonal area. Maximum temperature rises up to 42 degree centigrade during the summer and minimum temperature falls to 10 degree centigrade in winter. The mean annual temperature is 28.°C. The average relative humidity varies from 47% to 83%. Maximum amount of rainfall is occurred by the south-western monsoon in the months of June to September. The average annual rainfall is 1605 mm. The climate become hot and humid during the summer and it becomes pleasant in winter. April and May are the hottest months where as December and January are the coldest months of the city.

**Changing Climatic Condition of Kolkata:**

Drastic change has occurred in the physical environment of Kolkata by the severe intervention of human population into it. Industrialisation along with the ever increasing unplanned urbanisation and population explosion has altered every corner of the city. According to the recent assessment of World Health Organisation Kolkata gets the fourth position in the most polluted cities of the world. Density of population per square kilometre was 24,806 in 2011. Now it would be exceed 25000 per square kilometre. One third of the total population is residing in the slum areas. Density of population here sometime exceeds 100,000 population per sq. Km. These are the most pollution generating units of the city Most of the slum dwellers are poor people.. There are about 40,000 pavement dwellers are live in the city. Air pollution is the major problems of the city which becomes severe in the office times and also in winter season. There are more than 80,000 registered and unregistered industrial units, located in Kolkata. These have profound influence on the rise of air temperature.

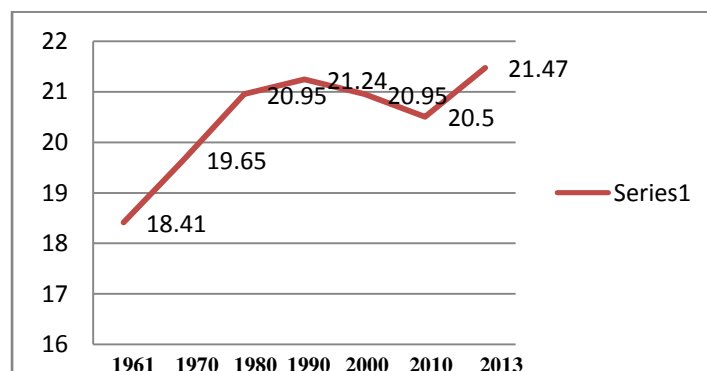
**Fig.1. Average Temperature Conditions of Kolkata City in 1960 and 2015 (degree centigrade)**



Source: : India Meteorological Department, Eastern Region, Kolkata

It is observed from the Fig 2 (below) that the mean monthly temperature of the month of December is showing an increasing trend from 1961 to 1990. In 1961 temperature of Kolkata was 18.41°C. It was 21.24 °C in 1990. After that it was declining up to 2010. There after a sharp increasing trend has been set in. The average increase of temperature between 1961 to 2013 is 3.06°C. It is a local warming, mostly generated by the anthropogenic causes. In the last few years Kolkata experienced a mild- warm winter and severely hot—humid summer..

**Fig 2 The Variation of Atmospheric Temperature in Kolkata in the month of December (1961-2013)**

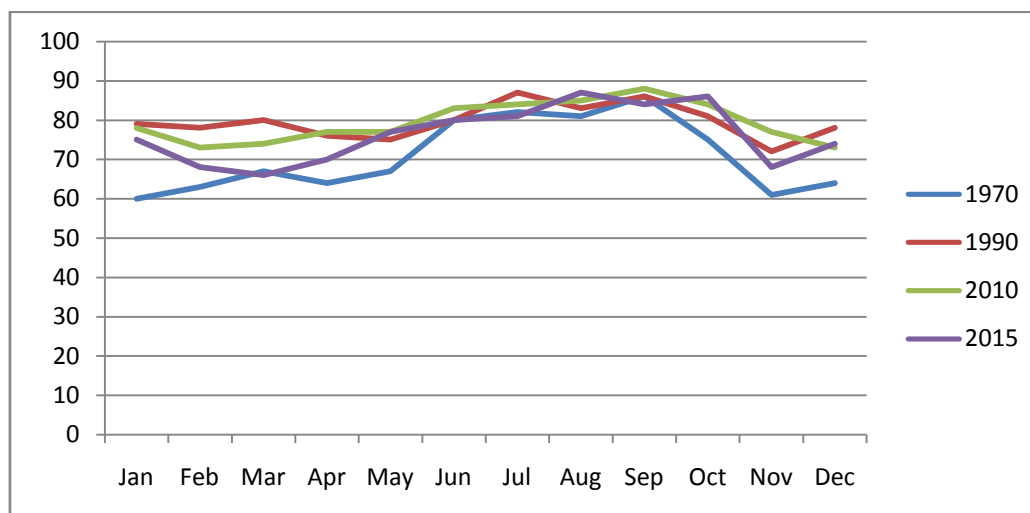


Source: India Meteorological Department, Eastern Region, Kolkata

Water Vapour is one of the important Green House Gases which trap the outgoing solar radiant energy and helps to increase the air temperature. The share of relative humidity of atmosphere is also showing an

increasing trend in Kolkata. In the figure 2 (below) it is found that relative humidity ranges between 66% to 87% in 2015. Even in winter season it was 75% in January and 74% in the month of December in the same year. Whereas 60% to 65% of relative humidity of the atmosphere was observed in the month of Jan, Feb, April, May, Nov and Dec in 1970. It was reached 80% only in the rainy seasons from June to September). So with the increase of the atmospheric temperature the rate of humidity is also show an increasing trend in Kolkata

**Fig 3. Comparative Relative Humidity ( in %) condition of Kolkata City in the year of 1990, 2000 and 2015**



Source: : India Meteorological Department, Eastern Region, Kolkata

### **Disappearance of the Seasons:**

Before the decades of 2000 Kolkata was experienced six seasons in a year- Summer, Rainy season, Autumn, Pre-winter (Hemanta), Winter and Spring. At present there are three seasons in Kolkata- Summer, Autumn and mild winter. Changing nature of the climate has been reflected on the rain fall distribution of Kolkata. In last three consecutive years South West Monsoon reached delayed at Kolkata of about 20 to 25 days in a year. Whereas rainfall distribution continued upto the mid of October (after the withdrawal of monsoon) with the help of depressions and cyclones.

## **II. CONCLUSION:-**

According to the Atmospheric Scientists -increase of the atmospheric temperature is the major cause of the erratic nature of the climate of Kolkata. Major green house gases like carbon dioxide, methane, nitrogen oxide, sulphur dioxide, carbon mono oxide, CFC, water vapour, hydro carbon soot, HFC, aerosol, are discharged from the automobiles, industries, domestic fuels, overall changes of the land use etc. Other causes of the alteration of the city- environment are congestion created by over population, traffic congestion, unplanned expansion of the city. . Treeless city is facing thermal pollution from the concrete buildings for the want of shelter for the ever increasing population of Kolkata. Man-made emission is considered as the major cause of the rise of atmospheric temperature and associated climate change of the city in recent years..Both the air and thermal pollutions are mainly concentrated in the lower layers of the atmosphere. The concentration of these elements into the lower layers increases the heat in these segments than the upper layers of the atmosphere. As a result it is observed that the average temperature of the lower layers of the earth's atmosphere has increased on 0.5°C (overall) to 0.7°C by the anthropogenic activities on the earth surface. Global warming and climate change is not only the problem of Kolkata itself. Whole India is suffering from the erratic nature of climate. As a result different types of climatic hazards are experienced by the people of the Indian sub continent like floods (even in the arid and semi arid areas), droughts, increased frequency and intensity of the cyclones; cloud blasting, flash floods etc. Kolkata is slowly becoming a heat island. The impact of which has been reflected on the changing disease pattern. It is becoming an endemic and epidemic zone of different newly generated diseases and also the resurgence of some infectious diseases like Japanese Encephalitis, Chikungunya, Dengue, Malaria, Gastroenteritis, resistant Tuberculosis and so on. Whole hearted efforts of the all urban planners, architects, the local, state and central governments should have to be needed to worked together and reduce the rising trend of temperature of Kolkata. Otherwise the city will suffer seriously with the warming and the erratic

nature of the climate. Following mitigation measure should be adopted to decrease of atmospheric temperature of the area. These are as follows:-

1. Control of the emission of Green House Gases.
2. Control of deforestation to maintain the ecological balance.
3. Construction of green buildings to control the thermal pollution.
4. Control of air pollution by the use of vehicles followed by standard emission norms created by the concerned department of Central and State Government.
5. Use of CNG as fuel for vehicles.
6. Improvement of the unhealthy slum areas.
6. Awareness generation into the common people regarding the causes and consequences of global warming and climate change.

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