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Global Mean Temperature Changes in 21st Century

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Abstract

The Global Mean Temperature (GMT) for 1880-2013 was collected from NASA, USA. The GMT were plotted and analysed. The rate of warming and the characteristics of the plot were discussed. The decadal changes of GMT were analysed. The trend of GMT was positive after 1900 except 1940-1949 period. The hotter periods of last century were marked and they have reported only after 1998. The concentration of carbon emission for 1000-2009 were collected from Energy Agency (IEA), USA and analysed. The future levels of Carbon concentration and GMT are having the positive correlation.

Keywords:

Global Mean temperature (GTM); Global Warming; Carbon concentration

Introduction

The global mean temperature (GMT) has been used as an important proxy for climate change studies. Many scientists have agreed that industrialization, population growth and solar radiance are the driving forces for the increase of global air temperature. The increase in greenhouse gases stimulates the sudden rise in global air temperature. Monetary of greenhouse gases and solar radiance are the risky tasks when compared to the monetary of air temperature. The trend of air temperature directly indicates the trend of greenhouse gases and Carbon di oxide emission ranges in the globe. Smith et al., (2000) state that global mean temperature is the most feasible tool for analyzing the trend of prevailing climate conditions for the past and future.

Houghton et al., (2001) also state that global mean temperature has been changing according the concentration of greenhouse gases and regional environmental changes. Some researches has been emphasized the potential changes of climate due to the solar radiation and natural climate cycle phenomena. This paper shows the variation of global mean temperature for the past century and the anomalies recorded with respect to the surface air temperature.

GMT Data Analyses

Average global temperature data for 1880-2013 were collected from the Earth Policy Institute from National Aeronautics and Space Administration, USA. The average global temperatures of last 134 years were plotted and the variations were studied. The maximum temperature is 14.67^0C and the minimum temperature is 13.53^0C. Over the last 134 years the global mean temperature have risen nearly 2^0C. Vose et al., (2005) found that the global minimum temperature (T_{min})increased more rapidly than maximum temperature(T_{max}) during 1950-2004 and reported that $T_{min}$and T_{max}increased $+0.29^0$C. From this study, the temperature rise has clearly seen in the plot (Fig.1). During 1880-1900 the global mean temperature has fallen to minimum range and after 1990, the temperature started to rise. The GMT has followed an oscillated trend but it has been steadily increased. In

many places the plot fell down and rose immediately. The cycle of temperature rise and fall has been noticed from the chart. The lower temperature continuous for few years then it increased suddenly for another few years. There are many rises and falls have been occurred in the GMT repeatedly. This manner of rise and fall can be considered as temperature change cycle. The black circles are shown the rises and the blue circles are the falls mentioned in the figure 1.

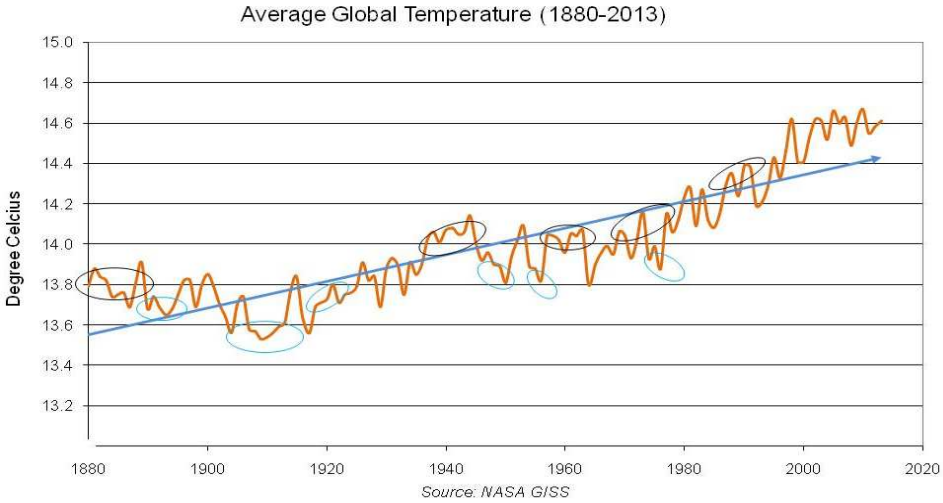

Fig.1. Average Global Mean Temperature

The temperature variation of each decade was also calculated and plotted (Fig.2) for the discussion. The plot shows the nature of GMT that the deviation from past decades. From 1880 to 1990 the temperature had been decreasing and after it started increasing till 1940. Again it was decreased from 1940 to 1960 and has been increased still 2013. These results also show the cycle of changes in GMT for the past 134 years. After 1900, the GMT has been raising and having positive deviation values except 1940-1949 periods. The industrialization and urbanization were geared for the last 60 years and the GMT also warmed in recent years. In each decade, the deviation is positively increased.

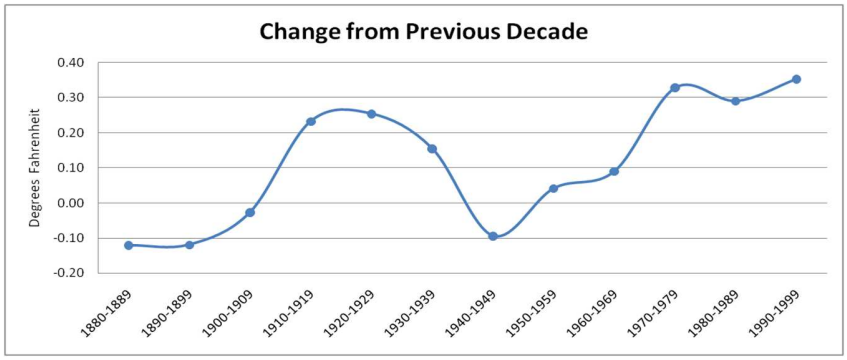

Fig.2. GMT Changes from Previous Decade

The hotter periods are really producing impacts on the environment and the biodiversity and ecological condition also been disturbed. The hotter years are mentioned in Fig. 3. Year 2010 is the hottest year in 21stcentury and 2005, 2007, 1998, 2002, 2003, 2013, 2006, 2009 and 2012 are the hotter years stand in descending order. According to the research convened by Houghten et al. (2001), the GMT will rise from 1.4^{0}C to 5.8^{0}C in 2100. This study reveals the nearly 2^{0}C rise of GMT. Also, few studies conveyed that, the climate change impacts will be witnessed through extreme events and climate variance. The rate of climate change will also be significantly increased. Watson and the Core Writing Team (2001) say that the temperature of the earth will rise even beyond 21st century.

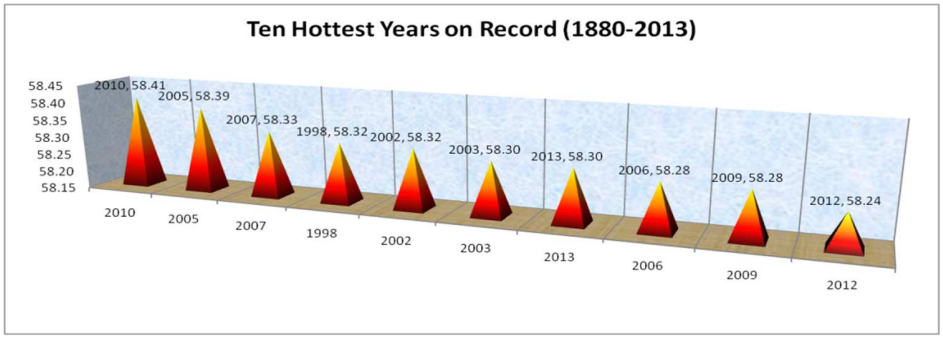

Fig.3. Hotter Periods

From the above results, the GMT has risen during the recent years which are the period of industrialization. The carbon emission has been playing a vital role in the global warming and greenhouse gases are also producing integrated effects. The atmospheric concentration of CO2 has been steadily increasing after 1900 and the rate of increasing tendency has also high in last century. There are many sources for the Carbon emission and the table discussed the rate of emission and the sources. The International Energy Agency (IEA) has computed data for the future rate of emission displayed in the Table.1. The table clearly explained that the Carbon emission has been increasing and in 2020 it will attain a higher range. Carbon concentration has the direct relationship with GMT because of the greenhouse effect. Hence in 2020, there will be the possibility for a significant Global Warming.

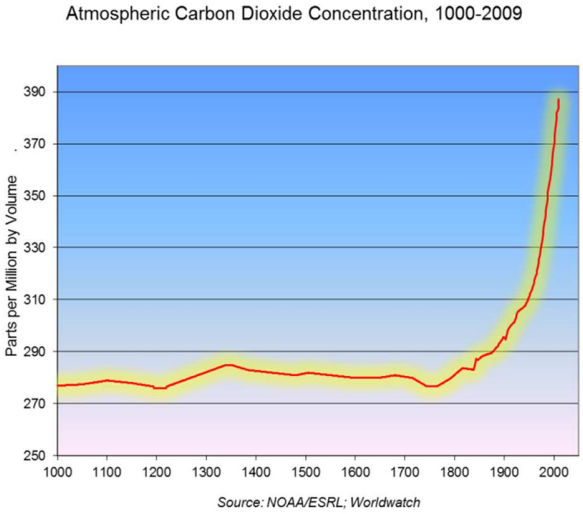

Fig.4. Carbon Concentration in Atmosphere

Table.1. Carbon Emission

Emissions	CO_2 Emissions, 2006	CO_2 Emissions, 2008	CO_2 Emissions, 2020
	Million Tons Carbon		
By Fuel:			
Coal	3,185	3,431	4,555
Oil	2,937	2,947	3,454
Gas	1,484	1,602	1,918
Total CO_2 Emissions	7,606	7,980	9,927

Conclusion

The Global Mean Temperature were increased nearly 2^0C in last 134 years. The minimum temperature recorded is 13.53^0C and the maximum temperature recorded in 14.67^0C. The GMT has risen steadily and the rise and fall have occurred repeatedly. After 1990, the GMT attained a greater level with a small rises and falls. The results support the impacts of urbanization and industrialization on Climate. The solar radiation has also been supported by many researches for the GMT rise. The decadal changes of GMT were analysed and the results shows the increasing pattern. There was a cool period reported during 1940-1970 then the GMT attained higher values. Except 1940-1949, the GMT has the positive changes that indicate the Global Warming effect of the atmosphere. The hotter periods of last century were recorded and the higher temperatures were attained after 1998. The highest temperature was recorded at 2010. The Carbon emission data for 1000-2009 were plotted and the plot shows the ascending manner at course of time. The Carbon concentration has accelerated after 1900 and the rate of carbon emission in 2020 also will be increased to 9,927 Million Tons Carbon. The results indicate the positive relationship of Carbon emission with GMT. This paper analysed the data provided by the NASA and International Energy Agency (IEA), USA and reveals the Global warming effect from the rise of GMT.

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