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Critical Study of the Disturbance in Meteorological Parameters Due to Global Warming

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Abstract: To study the relationship between global warming and change in meteorological parameters at regional level. Nagpur is central most cities in Indian domain and truly represents the effect of all directional weather changes. It has well settled three seasons, that is summer, monsoon and winter. It is reported that this well settled seasonal phenomenon is now showing disturbance. Numbers of meteorological parameters like temperature, difference of temperature in day and night is not harmonious as reported previously that is before 1990. The study also compares the temperature pattern disturbance before 1990 and after 2005. The difference of roughly 20 years will show us whether there is any change in pattern of temperature during various seasons.

Keywords; Global Warming, Meteorological Parameter, Directional Weather Change, Temperature

I. INTRODUCTION

A. Global Warming

The constant change in the behaviour of the environment is the global concern. It is clearly reported that the weather pattern is shifting and also disturbing. This may be due to the Global warming but there is need to understand the relationship between the meteorological parameters and global warming. Global warming refers to an unequivocal and continuing rise in the average temperature of Earth's climate system. Since 1971, 90% of the warming has occurred in the oceans. Despite the oceans' dominant role in energy storage, the term "global warming" is also used to refer to increases in average temperature of the *air and sea at Earth's surface*. Since the early 20th century, the global air and sea surface temperature has increased about 0.8 °C (1.4 °F), with about two-thirds of the increase occurring since 1980. Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. Before any discussion about the causes and effects of much talked about issue of global warming, it appears to be most appropriate to quote Richard Houghton and George Woodwell: "*The world is warming. Climatic zones are shifting. Glaciers are melting. Sea level is rising. These are not hypothetical events from a science fiction movie; these changes and others are already taking place, and we to accelerate over the next years as the amounts of carbon dioxide, methane, and other trace gases accumulating in the atmosphere through human activities increase*". True, there is little doubt the present day holocaust of global warming is the outcome of human activities that are enhancing the greenhouse effect.

When we compare the temperature record of the past thirty years with that of any comparable periods, it is clear that warming has exceeded that of all periods. It has been so because of the building of greenhouse gases. A meteorological survey conducted in the troposphere is continuously increasing on account of the mad race among nations over the globe for development. Records of past climate going back as far as 160,000 years indicates a close correlation between the concentration of gases in the atmosphere and global temperature. Computer simulations of the climate indicate that global temperature will rise at atmospheric concentration of CO₂ increases.

B. Causes of Global Warming

There are numerous causes of global warming, and scientists typically divide those causes into two primary groups: natural causes and man-made causes. Such as, Sunspots, Arctic Tundra, Permafrost, and Water Vapour are the natural causes of global warming. Whereas, Burning of Fossil Fuels, Electricity Production, Automobiles, Deforestation, Fluorocarbons, Use of Fertilizers, Mining's, Increase in Population are the man-made causes which are also known as anthropogenic cause of global warming. While humans can do little to eradicate natural causes, it is possible to reduce or eliminate man-made causes.

C. Consequences of Global Warming and Climate Change

As increase in global warming causes some consequences which are increase in greenhouse gases, climate change, glaciers melting,

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etc. These results in, more droughts and floods. Impacts on ecosystem would change the crop production potential of a region, especially in Asia, Africa, and South and Central America., Concentrations of carbon dioxide, methane and nitrous oxide have increased since preindustrial era by 30%, 145% and 15% respectively, largely because of fossil fuels use, land use changes and agriculture, Biological diversity may reduce, some species could become extinct, Billions of people will affected by problem of drinking water supply, sanitation and drought.

D. To Whom Climate Change will Affect?

The most affected will be none but the poorest on the planet. Poor developing countries, particularly small island nation states will be the worst hit. A 15-95 cm rise in sea level could turn these people into refugees. Moreover, poor countries are least prepared to face the wrath of floods and hurricanes. Life styles of the future generation will be compromised. Plants and animals around the world will be drastically affected due to changing weather and some may even become extinct.

E. Meteorology

Meteorology is a science of atmosphere which studies the various processes and phenomena in the atmosphere including weather and climate. This study can be organized into Behaviour and properties of the atmosphere., Studies of the various processes in the atmosphere., Various phenomena in the atmosphere., Direct and indirect effects of weather on earth, ocean surfaces and life in general., Applications of these studies for forecasting weather.

F. Relationship between Global Warming and Meteorological Parameters

Air pollution results from the combination of high pollutant emissions and unfavorable weather. Air quality is strongly dependent on meteorological conditions, and is therefore expected to be affected by long-term changes in weather statistics, i.e., climate change. As we are now entering an era of rapid climate change, the resulting implications on air quality must be better understood for policy makers to formulate appropriate air quality regulations to ensure public health is not compromised in the face of climate change.

II. LITERATURE REVIEW

The most important weather events affecting India are heat waves, cold waves and fog, snowfall, floods and droughts, monsoon depressions and cyclones. Peoples' perception is in favour of changes in the frequency of occurrence of these weather phenomena. It is very essential to examine the observed data very carefully in order to categorize those as scientific evidences. In the recent past, studies have been conducted by several meteorologists (Srivastava et al. 1992; De 2001; Rupa Kumar et al. 2002; Dash and Rao 2003; Prakasa Rao et al. 2004; Kothawale and Rupa Kumar 2005) using the observed data as well as model results. Earlier, Paramanik and Jagannathan (1954) had analysed surface temperature data series over India. Based on these earlier studies, it may be inferred that the rise in annual mean temperature over India is comparable with the reported rise of global surface temperature by 0.6°C (Jones et al. 1999). Prakasa Rao et al. (2004) examined the effect of urbanization on the meteorological parameters at fifteen Indian cities and found that radiation values, bright sunshine hours, wind speeds and total cloud amounts have a decreasing tendency during the last 40–50 years whereas relative humidity and rainfall amounts show increasing tendency in some cities. It may be noted that increasing amounts of aerosols in the atmosphere can cut the amount of sun-light reaching the ground and hence lead to decrease in bright sunshine hours. Past results, in general, indicate warming during the post-monsoon (October–December) and winter (January–February) and no change in the temperatures during the monsoon season (June–September).

III. EXPERIMENTATION AND EXPERIMENTAL DATA

For the study the selected meteorological centre is Nagpur. Nagpur is having well equipped meteorological centre at Sonegaon, Nagpur airport. For the experiment, two sets of data collected and analysed. The first set is having data from 1988-1990 (called later on *Old Set*) and second set is having data from 2007-2009 (called later on *New Set*). There is the difference of 20 years. The harmony of the data plotted and checked for any unevenness in these two periods. The comparison between Old set and New Set reveal the changes due to global warming.

A. Meteorological Data

Meteorological data of year 1988, 1989, 1999 were collected from Meteorological Department, Pune, M.S. Data were collected directly from the computer file which is maintained by the department. Meteorological data of year 2007, 2008, 2009 were collected from Nagpur Meteorological Department, Nagpur, M.S. Data were collected by From the Nagpur Meteorological Department by

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gone there and this Data is also maintained by the Department. Meteorological data of *Old Set* and *New Set* contain Maximum temperature, Minimum Temperature, Rain fall, Wind Speed, Wind Direction & Relative Humidity.

B. Conversion of Meteorological Data in to Required Format

Meteorological department, pune, provides the data of year 1988, 89, 90 in compact format. To use this data it was compulsory to process these data and write in required format. Data were in the form of Hourly data which was converted in daily form for the study purpose, For example, data contains 24 readings of temperature of one day, which was then converted into maximum temperature and minimum temperature of the day by evaluate max-min temperature from the 24 reading. Meteorological data of year 2007, 08, 09 were in the correct form which is used for the study as it is.

C. Data Preparation for Experiment

Missing data were evaluated using average technique Previous two days and post two days data were averaged to calculate the missing data with the 5% significance level.

Though there are very less number of missing days.

The data distributed in the three quarters. Starting from the initiation of rainy seasons i.e.

For example:- 1st June to 30th September, 1st October to 31st January, 1st February to 31st may.

The reason to divide the year data into three sections is due to the Indian climate as it has three seasons' summer, monsoon and winter.

D. Data Set Preparation

On completion of previous process, the data were further analysed and arranged in tabular form. In this project, only variation in temperatures was analysed and the details are as follows: The data for each year divided into three parts depending on seasons.

Part I: 1st June – 30th September

Part II: 1st October – 31th January

Part III: 1st February – 31st May

For each year, for each day, the difference of maximum and minimum temperature calculated. (i.e. the difference of the day temperature). These temperatures represent the increase in temperature a day from actual minimum temperature. This increase in temperature is due to heat, generally sun heat. The calculated difference is then averaged for the full four months. The resultant is Average Difference in minimum and maximum temperature. It is represented by A . ($Average\ of\ T_{max} - T_{min} = A$)

E. Calculation of Expected Maximum Temperature

This is calculated by adding average (A) temperature to the minimum observed temperature for each day. It is represented by (ET_{max}). Calculation of Difference in actual observed maximum and Expected maximum (ET_{max}) for each day. This temperature is reporting the change in temperature may be due to external factors. (ΔT)

IV. RESULT

The obtained results are plotted season-wise.

Figure number 1, 3, 5 represents the analysis of Old Set of data.

Figure number 2, 4, 6 represents the analysis of New Set of data.

Figure 1 represents the graph between the Date and Actual Temperature – Expected Temperature in °C. This graph shows the variation from 1 February to 31st May of *Old Set*. In the graph, three various colours represents three different years.

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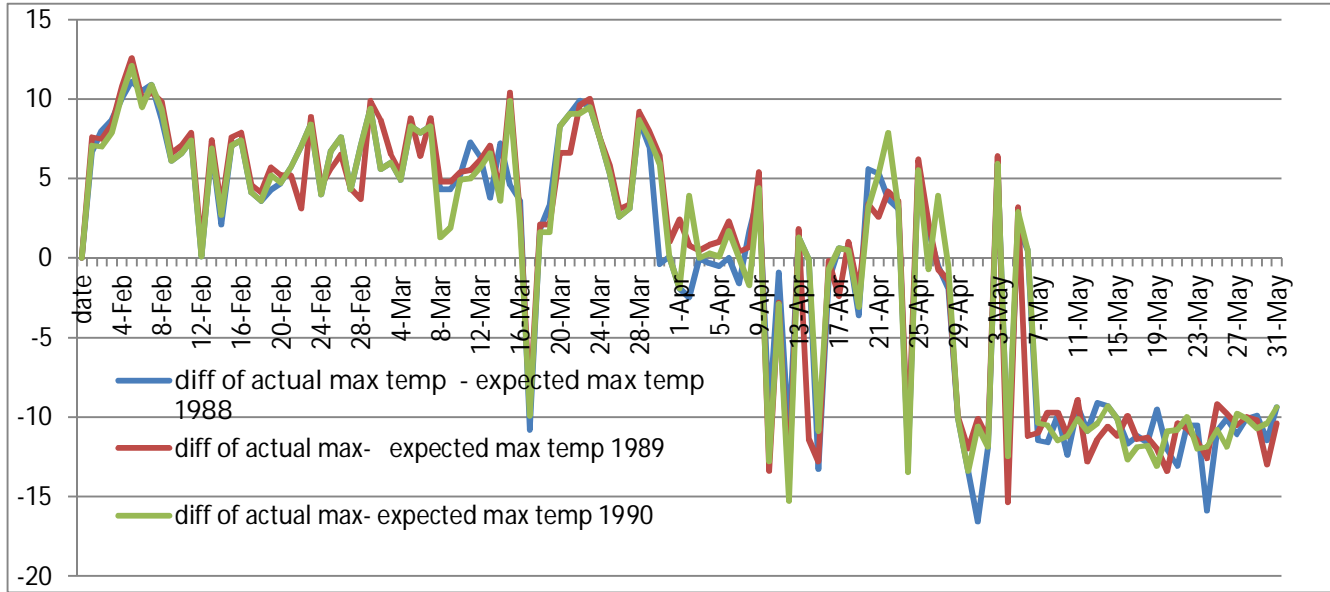


Figure 1. Difference of actual maximum temperature - expected maximum temperature of February -may (year- 1988, 89, 90)

Figure 2 represents the graph between the Date and Actual Temperature – Expected Temperature in °C. This graph shows the variation from 1 February to 31st May of New Set. In the graph, three various colours represents three different years.

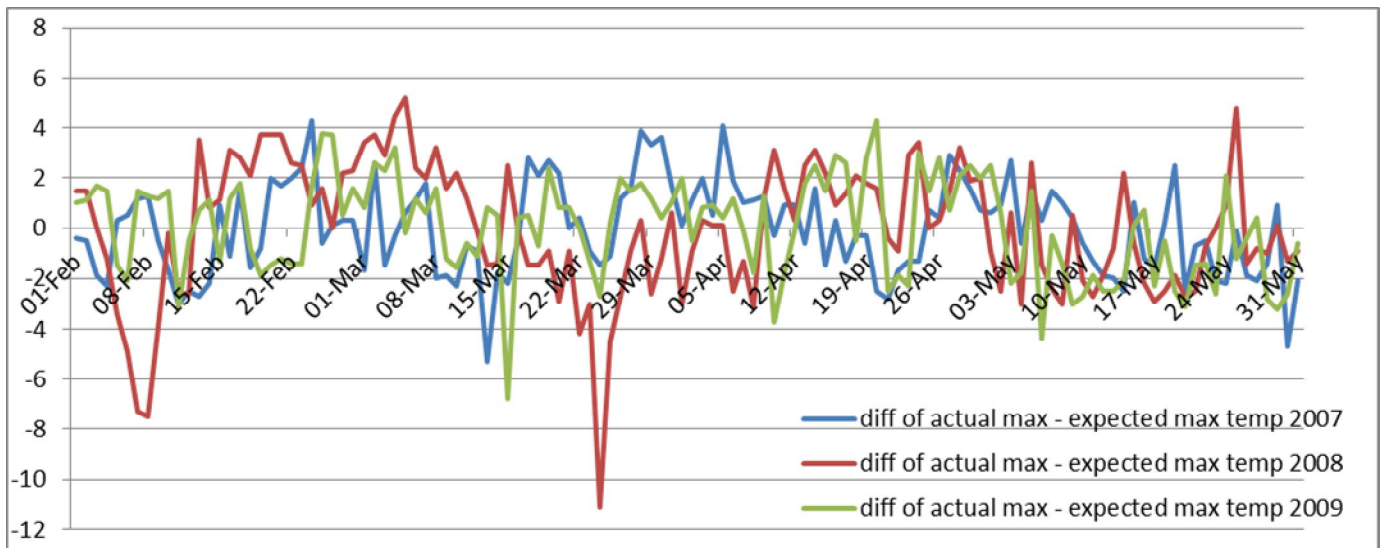


Figure 2 Difference of actual maximum temperature - expected maximum temperature of February - may (year- 2007, 08, 09)

Interpretation for the period: February – May (Old Set and New Set)

In case of Old Set, the initial trend is of higher temperature, which further goes down.

From Ending of March, the temperature goes down and minimum to -10 °C.

In case of New Set, it is reported that the trend is not harmonic and lots of fluctuations reported.

Figure 3 represents the graph between the Date and Actual Temperature – Expected Temperature in °C. This graph shows the variation from 1 June to 30 September of Old Set. In the graph, three various colours represents three different years.

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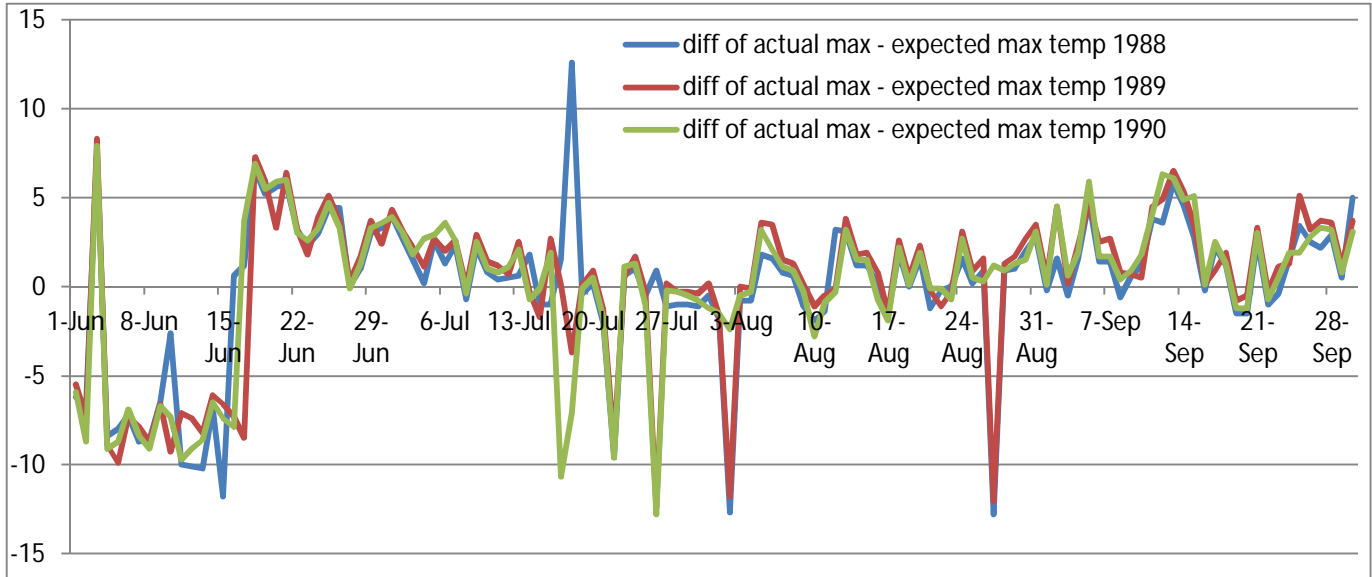


Figure 3 Difference of actual maximum temperature - expected maximum temperature of June - September (year- 1988, 89, 90)

Figure 4 represents the graph between the Date and Actual Temperature – Expected Temperature in °C. This graph shows the variation from 1 June to 30 September of New Set. In the graph, three various colours represents three different years.

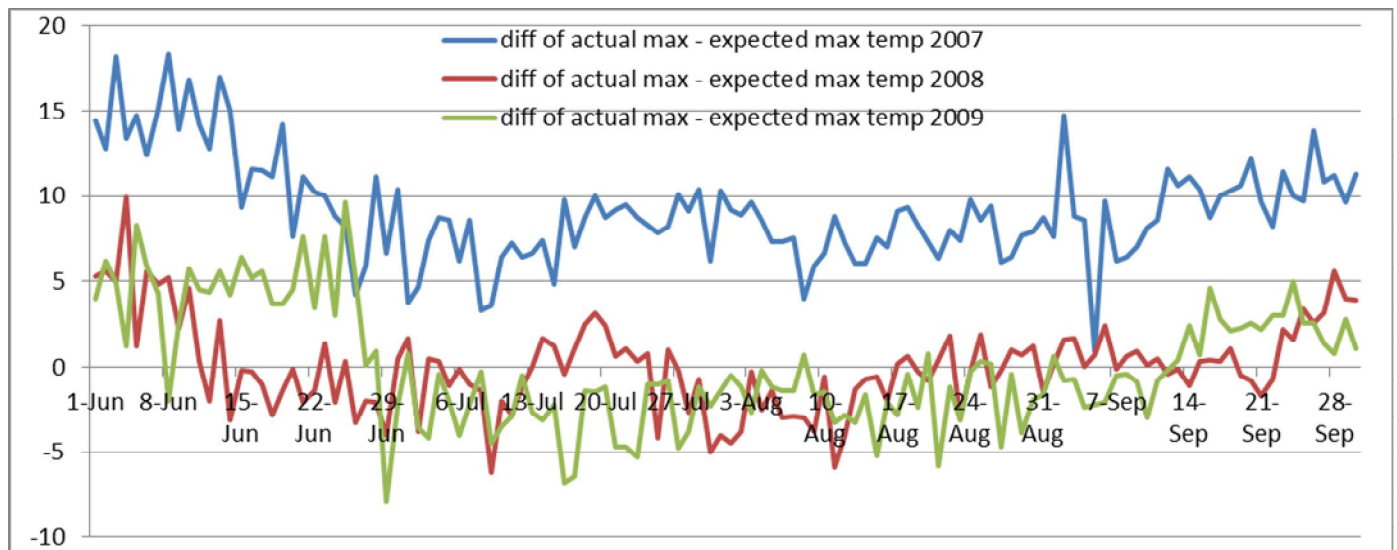


Figure 4. Difference of actual maximum temperature - expected maximum temperature of June - September (year- 2007, 08, 09)

Interpretation for the period June-September

In case of Old Set, the initial trend is of higher temperature, which further goes down.

From Ending of June, the temperature goes down and finally from August increases again.

In case of New Set, it is reported that the trend is not harmonic and lots of fluctuations reported.

Figure 5 represents the graph between the Date and Actual Temperature – Expected Temperature in °C. This graph shows the variation from 1 October to 31 January of Old Set. In the graph, three various colors represents three different.

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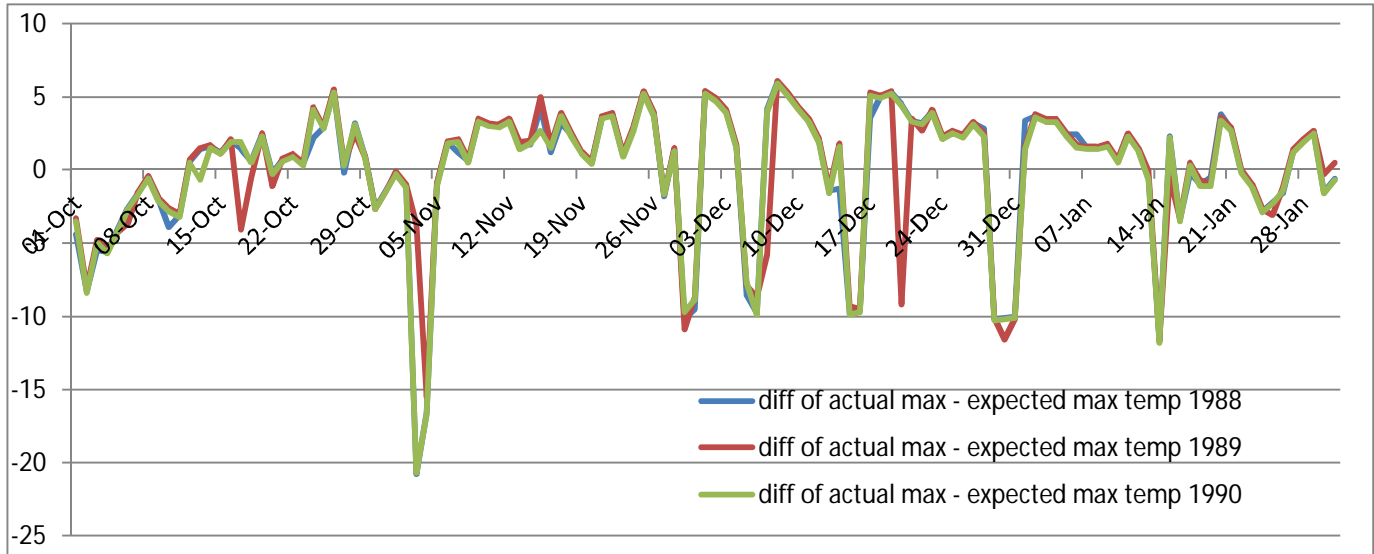


Figure 5. Difference of actual maximum temperature - expected maximum temperature of October- January (year- 1988, 89, 90)

Figure 6 represents the graph between the Date and Actual Temperature – Expected Temperature in °C. This graph shows the variation from 1 October to 31 January of New Set. In the graph, three various colours represents three different years.

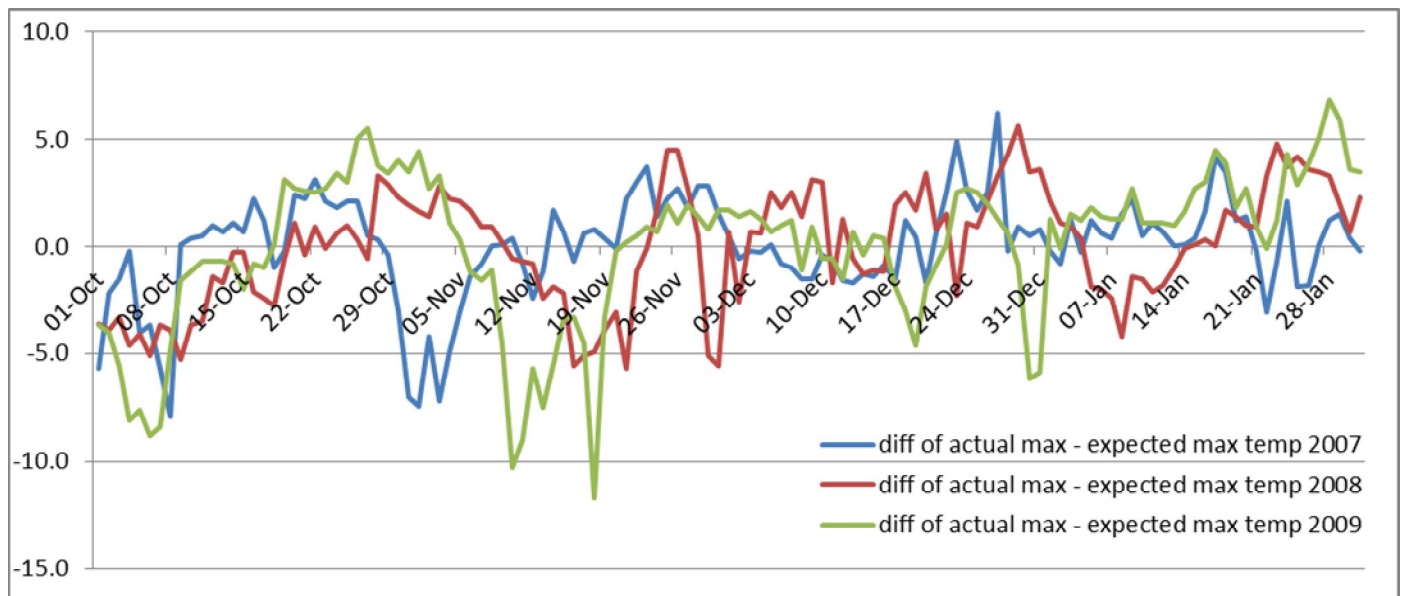


Figure 6. Difference of actual maximum temperature - expected maximum temperature of October- January (year- 2007, 08, 09)

Interpretation for the period October - January

In case of Old Set, the initial trend is of higher temperature, which further goes down.

From Ending of June, the temperature goes down and finally from August increases again.

In case of New Set, it is reported that the trend is not harmonic and lots of fluctuations reported.

V. CONCLUSION

From the above study it is concluded that the temperature pattern between 1990 and 2009 in roughly 20 years is got changed enormously and it is found that there is a great disturbance in temperature pattern when we are comparing the pattern of Old and New Set of data the harmony in pattern get lost and vigorous disturbance is noticed

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