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GEOGRAPHICAL ANALYSIS OF TEMPERATURE AS A INDICATOR OF CLIMATE CHANGE: PUNE DIVISION (MAHARASHTRA)

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ABSTRACT

The climate can thus be viewed as a mixture or aggregate of weather.Weather describes conditions of the atmosphere over a short period of time, and climate is how the atmosphere behaves over relatively long periods of time.The World Meteorological Organization (WMO), 30 years are the classical period for performing the statistics used to define climate. As a consequence, the 30 years period proposed by the WMO should be considered more as an indicator than a norm that must be followed in all cases. Climatic conditions help to shape various ecosystems and habitat around the globe. The climatic factors are impact on physical features as well as human life. It is a major role play in human environment and they also affects on his food, clothing, dwellings, and their occupations. Agriculture is our primary source of food;it becomes critical for human survival due to changing climatical conditions in the recent past few decades.

Changing climatical conditions in the Pune division of Maharashtra state has been considered for this work. The Pune devision is located in the western part of Maharashtra, which is well-known for prosperity of agriculture and industrial sector. But it is presently affected by climatic conditions i.e. increase in temperature, uncertainty and variability of rainfall, durations of seasons etc. These all conditions are directly or indirectly connected with above sectors.

Key words: *Climate, Temperature, Rainfall, Properties, Variablity, Agriculture, Industry, Mankind*

1.0 Introduction

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time that is decades to millions of years. Climate change, defined as the long-term imbalance of customary weather conditions such as temperature, radiation, wind and rainfall characteristics of a particular region, is likely to be one of the main challengesto mankind during the present century. As per Intergovernmental Panel on Climate Change (IPCC) usage climate change refers to a change in the state of the climate that can be identified by changes in the mean and or the variability of its properties, and persists for an extended period, typically decade or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the UNFCCC where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods. Indian Metrological Department (IMD) suggests that climate change refers to a statistically significant variation in either the mean state of the climate or in this variability, persisting for an extended period typically decades or longer.

The Inter-governmental Panel on Climate Change (IPCC, 2010) predicts that 2100 the increase in global average surface temperature up to 1.500 C to 2.50 C. India's climate is both diverse and changing. The south experiences tropical climates, through more temperate condition to alpine region of the north Himalaya (World Bank, 2008). The mean surface temperature of India is raised by 0.79° C from mean surface temperature. The maximum temperature over India has increased by 0.91°C and the minimum by 0.34°C in the last 114 years.

The seasonal temperature variation is considerably modified by the south-west monsoon. The spatial changes in minimum temperatures are observed to be decreasing in most parts of Western

Ghats. In the period of Pre-monsoon, maximum temperatures have increased significantly over the west coast (Kothawale and Kumar, 2005).

1.1 Study Area

The Pune division is located in south-west part of Maharashtra state. It lies between 150 45′ N to 190 0′ N latitude and 730 32′ E to 760 15′ E longitudes. The area under study comprises of five districts namely Pune, Sangli, Satara, Solapur, Kolhapur and the whole division has 58 tehsils. The Pune division is bounded by the Aurangabad district to the north and NE, Thane district encircled by north and NW. The west boundary of study area delimited by Raigad, and Ratnagiri district, Sindhudurg district enclosed in south and south-west part. The south and eastern boundary surrounded by Karanataka state and eastern boundary delimited by Osmanabad district.

Physiographical this region can be divided in to three parts hilly, plateau and lowlands. Sahydri ranges passes through Pune division; its slope decreases from west to east. In this region temperature varies in the different parts, the average temperature of the study area is 25.620 C. An average annual rainfall in the Pune division was recorded 1239.09 mm. There are major two river basins; it includes Krishna and Bhima basins.

The study region has total geographical area about 57, 275 km2. The study area having 23,449,051 population as per 2011census and out of the total population of the study region more than 58.76 per cent population has been located in rural areas and remaining population 42.24 per cent are living in urban areas. The population density was 403 persons per km2 and sex ratio was 953 females per thousand males according to 2011 censes.

1.2 Objective

The objective of present research work is to study the temperature characteristics in relation to climate change of the Pune division of Maharashtra state (India).

1.3 Data Collection And Methodology

The present work is based on secondary data and an essential data was collected from different sources such as district gazetteers, district census handbook, socio economic abstract and toposheets (SOI). The metrological data was collected from institution i.e. Indian Metrological Department of Pune. Through this institution monthly station-wise data of temperature over Pune division (1901 to 2013) has been collected.

The India yearly temperature data had been taken through the website such as www.indiawaterportal.in, www.tropomet.res.in (1901 to 2011). The 0.250 X 0.250 gridded temperature data of Pune Division had been taken from Global Weather Data website of the period of 1979 to 2013. The drought data had taken from http://agri.gujarat.gov.in.

The collected secondary data were processed by using different statistical and quantitative techniques for getting correct results. During the investigation various methods were used satisfy the objectives. The climatic parameter such as temperature trends were processed by using MS- Excel Windows office 2010. To supporting present work researcher has prepared map with the help of GIS technique.

1.4 Temprature

The temperature is parameter to measure of intensity of heat energy; it is generally expressed in Degree Celsius (ºC). Temperature is a major determining factor of global climate patterns and it affects the life cycles of plants and animals, influences weather and tide, and control the freeze and thaw of the polar ice caps (Meena, 2013). A small change in average temperature can have powerful effects on the worldwide environment. The temperature is important indicator to the analysis of climate change. The yearly maximum, minimum and mean average temperature of the study area describes the temperature variability and temperature trends. In the present research work the researcher has attempted to analysis yearly, decadal and seasonal temperature conditions over Pune

division considering 110 years period (1901 to 2010) according to table 1.1.

1.4.1 Maximum Temperature

The maximum highest temperature is during a specified duration.The average daily maximum air temperature, for each month and as an annual statistic, calculated over all years of record. The maximum temperature over Pune Division from 1901 to 2013 is showing an increasing trend of 0.980C (fig.3.4). The temperature is increasing at the rate of 0.00870C per year. The maximum temperature is increased from 30.440C in 1901 to 31.980C in 2013. The maximum highest temperature is (32.240C) in 2003 and maximum lowest temperature recorded 29.980C in the year 1997.The decadal trend shows in Table 3.1 that is maximum temperature also designated that the rise (0.30C) is pitched in the decade 1941-50. The warmest decade (2001-10) in Pune division is observed and it recorded with 31.540C maximum temperature,while the coolest decade was 1931-40 which has recorded an about 30.330C maximum temperature.

Table No. 1.1

Decadal Temperature Condition in Pune Division (1901 to 2010)

Decade	Maximum Temperature in ^{0}C	Minimum Temperature in ^{0}C	Mean Temperature in ^{0}C
1901 -10	30.40	20.00	25.20
1911 -20	30.70	20.30	25.50
1921 -30	30.70	20.20	25.40
1931 -40	30.30	19.90	25.10
1941 -50	30.60	20.20	25.40
1951 -60	30.80	20.40	25.60
1961 -70	30.90	20.40	25.60
1971 -80	30.90	20.40	25.70
1981 -90	31.00	20.60	25.80
1991 -00	31.20	20.60	25.90
2001 -10	31.50	20.60	26.10

Source: Based on Global Weather Data,1901 to 2010

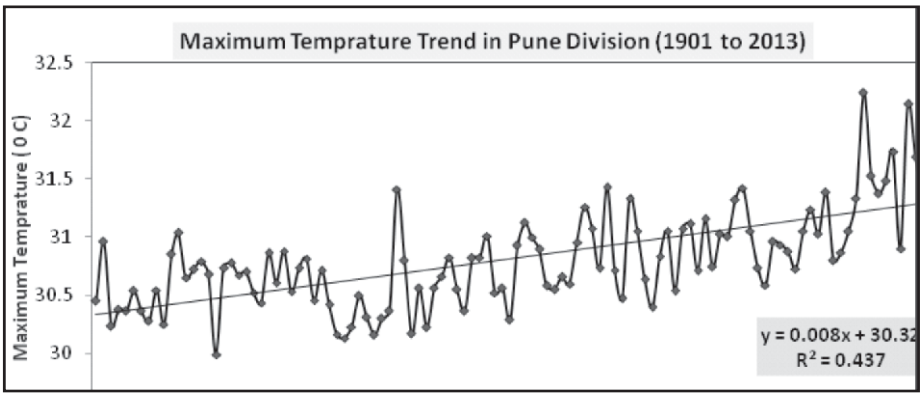

Fig. 1.1

1.4.2Minimum Temperature

The lowest temperature attained at particular place in particular time. The lowest temperature is recorded diurnally, monthly, annually and seasonally or the entire lowest temperature is also recorded. The minimum temperature over Pune Division from 1901 to 2010 was raised by 0.680C (fig. 1.2). The minimum temperature was recorded 20.020C in 1901 and in last considered year (2013). It was reported by 20.800C. an increasing rate of temperature is 0.0060C per annum. The highest minimum temperature (21.00C) is recorded in 1969 and lowest minimum temperature (19.170C) in 1917. The fig. 1.1 is reveals that year-wise it shows up and downs in minimum temperature but overall trend of such temperature is increasing and it is positive indicator of climate change.

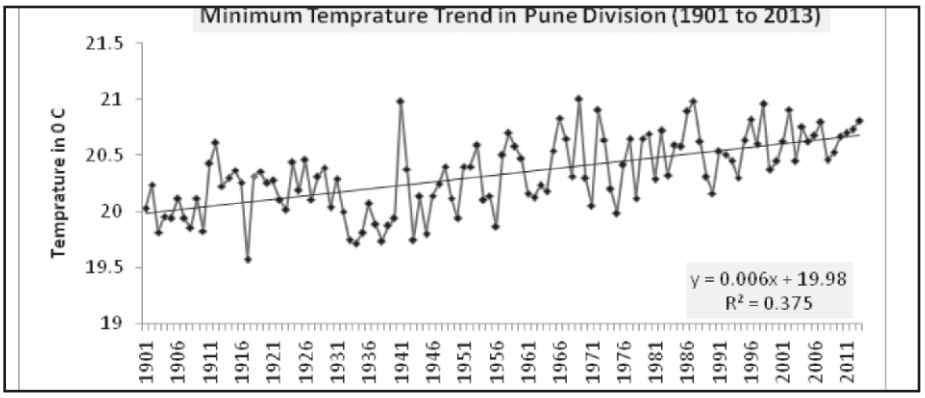

Fig. 1.2

The decadal trend shows (Table 1.1) minimum temperature also designated that the rise by 0.060C and it is shown high-pitched in the decade 1941-50. The warmest decade in Pune division was recorded in 2001-10 and it reports 31.540C minimum temperature. The coolest decade in the Pune division was 1931-40 which has average 19.910C minimum temperature.

1.4.3Mean Temperature

The mean annual temperature refers to the average of the maximum and minimum temperatures of a year or specific period. The mean annual temperature is a valuable climatological

tool that can assess an area's climate change. The mean temperature over Pune division from 1901 to 2013 exhibited a rise trend of 0.830C (fig.3.7). The 25.230C mean temperature noted in 1901 and 26.390C in 2013. The difference between mean temperature of 1901 and 2013 shows 1.160C increase in mean temperature and its per annum raising rate was 0.0070C. The highest mean temperature (26.390C) recorded in 2013 and lowest mean temperature (24.780C) in 1917.

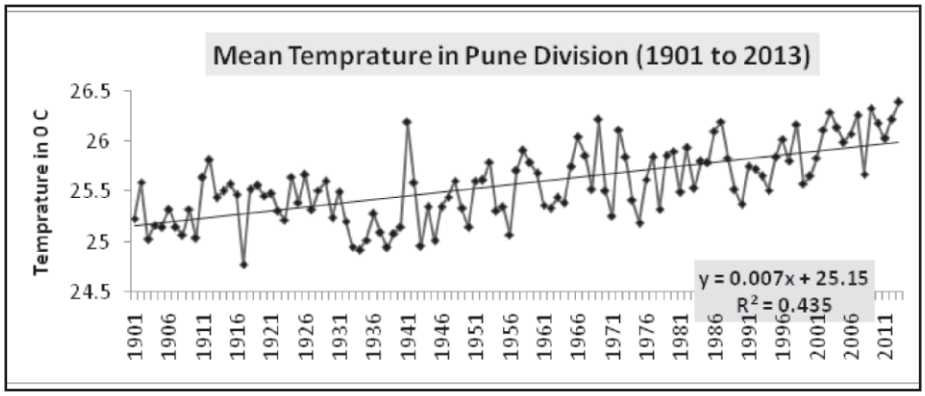

Fig. 1.3

The decadal trend shown intable 1.1,the mean temperature also designated that the rise of 0.070C high-pitched(0.30C) after 1941-50. The warmest decade in Pune division was 2001-10 recorded 31.540C. The highest decadal mean temperature is perceiver. The warmest decade in Pune division is 2001-10 and it recorded with 26.090C by mean temperature. The coolest decade in the Pune division was 1931-40 and in this decade 25.120C mean temperature was recorded.

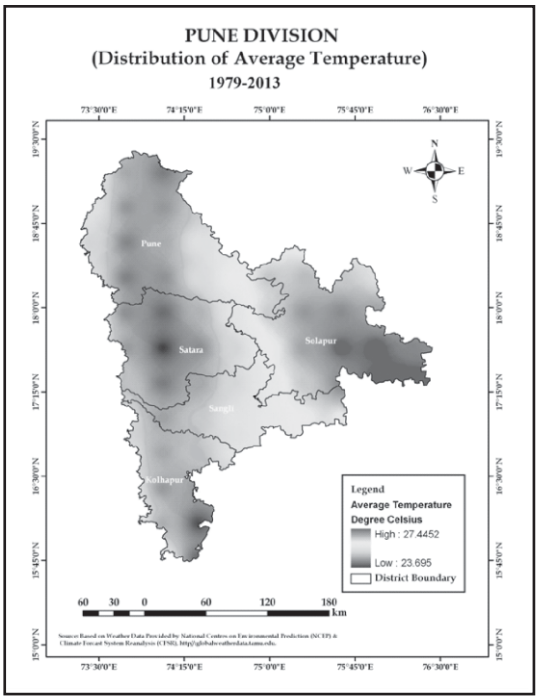

Fig. 1.4: Spatial Temperatures Distribution in Pune Division (1979 to 2013)

Conclusion

It is concluded that the temperature variation throughout the year. According to linear trend estimation shows that 0.83° C from mean surface temperature of the Pune Division which is increased in the considered period (1901 to 2013). An average maximum temperature of Pune division has increased by 0.98°C and average minimum by 0.63°C in the last 114 years.

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