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Temperature and Rainfall Trends in North Western Maharashtra :
A Geographical Approach

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Abstract

North western Maharashtra is one of the susceptible sections to climate deviation particularly to temperature and rainfall alteration. Rainfall and temperature are most contributing factor for the climate pattern to the study area because mostly of the agriculture in this region is dependent on Monsoon. The major intend of this study was to explore tendency in temperature and rainfall in the annual, seasonal and monthly time scale. The daily rainfall and temperature data were collected from Indian Meteorological Department, Pune (MS) and Hydrological Data User's Group (HDUG), Nashik (MS). The Statistical methods and estimator were used to assess rainfall and temperature trends. The Statistical methods revealed that non- significant decreasing rainfall trend was observed during February to March and September at study region. Both maximum and minimum temperature revealed that statistically significant decreasing trends in annual and seasonal time scale. On the other hand, a non- significant warming trend of minimum temperature was observed during annual time scale but a non-significant decreasing trend was experienced during winter season. Increase in temperature and decrease in amount of rainfall may have a negative impact on crop production and soil water balance. Therefore, this study could have an important role in identifying possible present and future production strategies.

Keywords: Rainfall; Temperature; Trend analysis; Nashik; Agriculture

Introduction:

Temperature is a main component of the earth's environment all the environmental variations and the weather phenomenon are affected by the temperature. Mainly temperature is the degree or the intensity of hot and coldness of the environment and earth's substance. Here we are discussed about the mean of the average temperature, average maximum temperature and average minimum temperature with the variation and trend regarding the annual, seasonal and the monthly by the space and time. Spatially all the district with tahsilwise and the temporally for from the year 1980 to the year 2016 total for the 37 years trend was analyzed.

Rainfall is a phenomenon that always determines all the economic related developments of the region. Agriculture is the most fragile phenomenon that most of the time affecting by the rainfall variation mainly cropping pattern, crop combination and the crop diversification and crop yield, production was affected by the high rainfall or the deficit rainfall.

Study Area:

North eastern part (Nashik District) is situated in the Deccan trap of Maharashtra which is partly in the Tapi Basin and partly in the upper Godavari Basin. It lies between $19^0 35' 18''$ North latitude to $20^0 53' 07''$ North latitude and $73^0 16' 07''$ longitudes to $74^0 56' 22''$ East longitudes. It is surrounded by Dhule district in the North, Jalgaon and Aurangabad district in the East, Ahmadnagar district in the South, Thane district in the South-West and Gujarat state in the North-West. Nashik district has an area of 15530 sq. km. and population of 6,109,052, as per the 2011census. There are 15 Tahsils and 66 revenue circles are in the Nashik district.

Objectives:

1. To the analysis of Spatio-temporal variability of temperature and rainfall in the study area.
2. To analyze the trend of temperature and rainfall scenario in the district.

Data Base and Research Methodology:

Climatic data was collected by various sources the data is related to the Rainfall pattern, Temperature, this data was collected for the year 1980 to the year 2016, and for the research data was

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analyzed with the help of various statistical methods in the form of average, variation, standard deviation, skewness, kurtosis etc.details of data collected from following sources are mentioned as below.

1. Data collected from India Meteorological Department (IMD) Shivajinagar, Pune.
2. Data collected from Hydrology Project (HDUG) Nashik.

Results and Discussion:

1. Trend of Temperature (1980-2016)

Temperature tendency was compute intended for the mean temperature, minimum temperature and maximum temperature from the year 1980 to the year 2016.

A) Trend of Average Mean Temperature

Trend of average mean temperature demonstrates the increasing trend for the district for computed period. The trend of the temperature shows (FIGURE NO 1) the ever-increasing still from the beginning, the low average mean temperature was recorded in the year 1980 it was 23.64^0_C and the high average mean temperature was seen in the year 2013 it was 25.01^0_C and from the year 1980 to the year 1992 the temperature trend was had around the 23^0_C and change around the 0.64^0_C to the 0.99^0_C .the constant average temperature
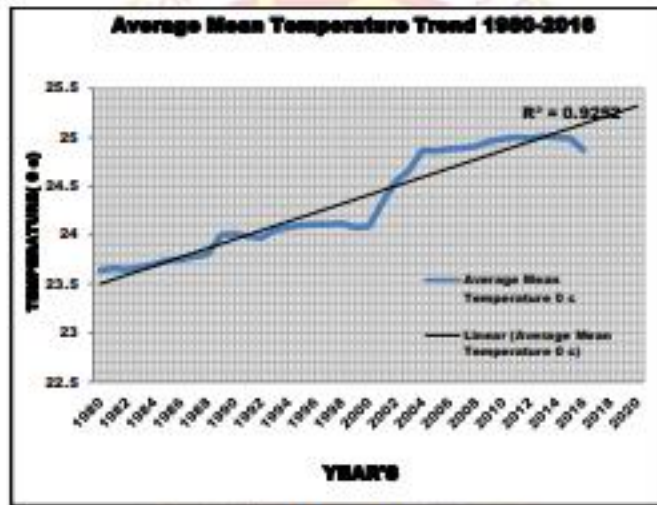

FIGURE NO : 01

seen from the 1993 to the 2010 it was around the 24^0_C and increasing steadily for every year around the 0.1^0_C to the 0.98^0_C. After 2011 it was reaches to the 25^0_C. The trend depicted r^2 value is 0.925 it means the temperature will be trending same direction in the future also, 92% is response variables for that trend. In the FIGURE NO 1 mean temperatures was predicted for up to 2020 and it portrayed the growing trend line.

B) Trend of Average Minimum Temperature

Trend of average minimum temperature demonstrate the increasing trend for the district for the year 1980 to the year 2016.

The trend of the temperature shows (FIGURE NO 2) the ever-increasing still from the beginning, the low average minimum temperature was recorded in the year 1980 it was 18.21^0_C and the high average

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minimum temperature was seen in the year 2016 it was 19.9^0c and from the year 1980 to the year 2005 the temperature trend was had around the 18^0c and change around the 0.21^0c to the 0.99^0c .the
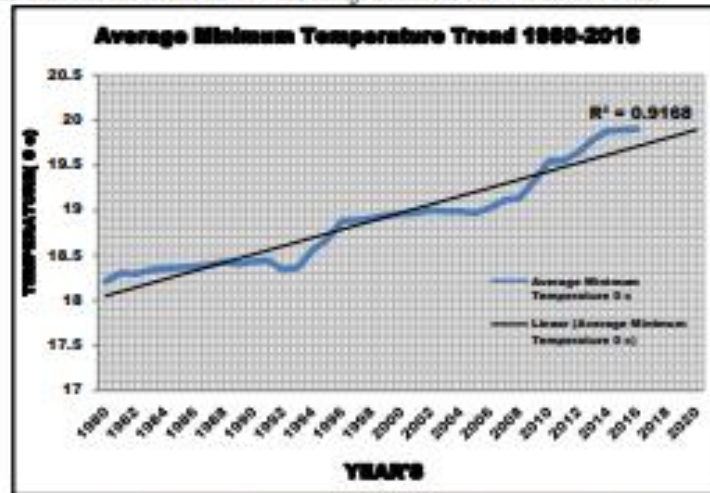

FIGURE NO: 02

The irregular average minimum temperature seen from the 2006 to the 2016 it was around the 19^0c and increasing suddenly for every year around the 0.02^0c to the 0.90^0c. The trend depicted r^2 value is 0.916 it means the temperature will be trending same direction in the future also, 91% is response variables are fitted for that trend. In the FIGURE NO 2 minimum temperature was predicted for up to 2020 and it portrayed the growing trend line. The rise in minimum temperature is challenging for the forth coming years, it would be reflected in the agricultural outcomes mainly crop yield and crop production.

C) Trend of Average Maximum Temperature:

Average maximum temperature trend express the escalating trend for the district form the year 1980 to the year 2016.
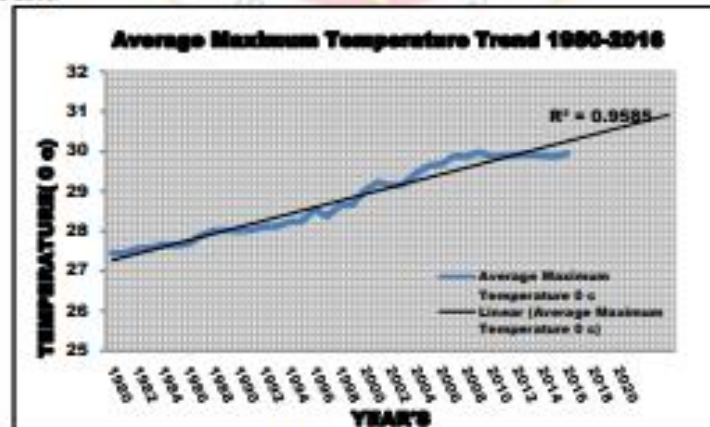

FIGURE NO: 03

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The trend of the average maximum temperature shows (FIGURE NO: 3) the ever-increasing still from the beginning, the low average maximum temperature was recorded in the year 1981 it was 27.44 ^{0}c and the high average maximum temperature was seen in the year 2011 it was 29.98^{0}c and from the year 1980 to the year 1999 the temperature trend was had around the 27^{0}c and change around the 0.44^{0}c to the 0.88^{0}c .the The slow change in average maximum temperature seen from the 1992 to the 1999 it was around the 28 ^{0}c and increasing gradually for every year around the 0.10^{0}c to the 0.66 ^{0}c .The trend depicted r^2 value is 0.958 it means the temperature will be trending same direction in the future also, 95% is response variables are fitted for that trend. In the FIGURE NO: 3 maximum temperature was predicted for up to 2020 and it portrayed the growing trend line. The rise in maximum temperature is also challenging for the forth coming years, it would be reflected in the agricultural outcomes.

2. **Trend of Rainfall (1980-2016):**

Average rainfall trend express the decreasing trend for the district form the year 1980 to the year 2016.
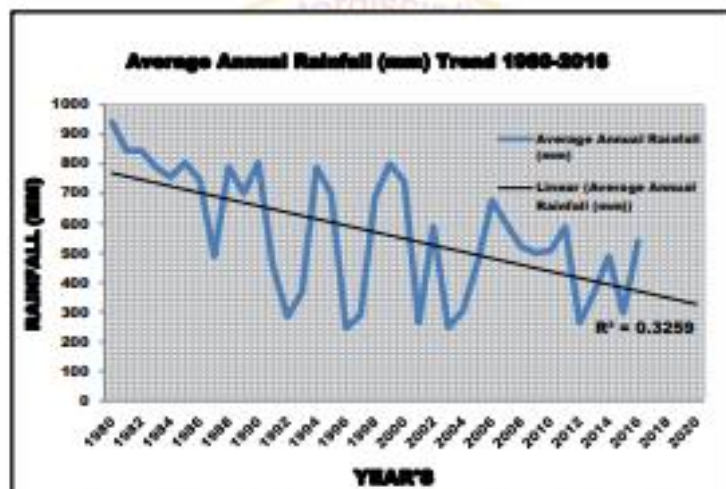

FIGURE NO: 04

The trend of the average rainfall shows (FIGURE NO: 04) the decreasing still from the beginning, the low average rainfall was recorded in the year 1996 it was 245.79mm and the high average rainfall was seen in the year 1980 it was 941.22 mm and from the year 1980 to the year 2016 the rainfall trend was had the uneven trend. Sometimes it shows the drastic rise or some years it shows the drastic fall in the levels of average rainfall .Above 800 mm average annual rainfall was had in the year 1981 it was 845.63 mm, 1982 it was 845.12 mm, 1990 805.22 mm, and in the year 1999 it was 800.25 mm. Below 400 mm average annual rainfall was had by the year 1992 it was 284.55mm,1993 365.99mm,1996 245.79 mm,1998 289.66 mm,2001 263.99mm,2003 247.99mm,2004 304.56mm,2012 263.88mm,2013 366.88mm and in the year 2015 297.8mm was had by above years most of the years are depicted as drought years mainly 1987, 1992, 1996, 1997,2001,2003,2004,2012,2013, and 2015.

The trend depicted r^2 value is 0.325 it means the rainfall will be trending not predictable direction in the future also, 32% is response variables are fitted for that trend. In the FIGURE NO: 04 average rainfalls was predicted for up to 2020 and it portrayed the decreasing trend line. The fall in average rainfall is

difficult for the forth coming years; it would be reflected in the agricultural outcomes and in the well beings of the farmers as well as it would be reflected in the scarcity of the water.

Conclusion:

Temperature determines the other weather elements of the study area like rainfall, precipitation, radiation, humidity, pressure, evaporation etc. hence all these factors are associated with the agricultural success of the region in this way temperature determines the agricultural practices of the region mainly cropping pattern, crop combination ,crop diversification and the crop yield and crop production of the region. Climate is constantly altering, and dynamic in temperament it is altering because of lot of factors included Physical, Chemical, Human made & Socio-Economic .Climate is a set of all weather elements and represents the summation or performance of these element for long period of time that is more than three decades. Climate transformation is alteration in middling condition of the Weather essentials over a long period of time particularly the change in arithmetical allocation of the weather conditions. Climate alteration substantiations are seen in the study area in the form of change and deviation in the rainfall, intensifying temperature level, repeatedly incidence of famines, dryness or low down intensities of moisture had observed in the region.

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