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ANALYSIS OF RAINFALL, HUMIDITY AND TEMPERATURE DURING THE YEAR JANUARY 1990 TO DECEMBER 2020 IN SOLAPUR DISTRICT, MAHARASHTRA STATE, INDIA

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Abstract:
Climate change has become a global issue that is taking a toll on the agricultural sector. This study has focused on climate change in the Solapur area of Maharashtra State, India. It is necessary to investigate the local meteorological characteristics using various statistical techniques to verify or regulate such a situation. To check the trend, meteorological data from the Solapur district, including rainfall, humidity, and temperature data, were analyzed by using the Man-Kendall test, and regression analysis was used to check the positive or negative trend. The result from an analysis of trends reveals that there is an increasing trend in the annual average maximum temperature and the decreasing trend in annual average humidity. There is no significant trend in the average yearly rainfall pattern.

Key words: Climate Change, humidity, rainfall, Solapur district, temperature

Abbreviation

Sq.kms. Square Kilometres
^{0}C : Degree Celsius
Avg: Average
Temp: Temperature
Max: Maximum
Min: Minimum
RH%: Relative humidity in percentage
Mm: Millimetre

1. Introduction:

Climate change will have an economic influence on agriculture, affecting agricultural profitability, prices, supply, demand, and commerce, among other things. Global warming reaching 1.5^{0}C in the near-term, would cause an unavoidable increase in multiple climate hazards and present multiple risks to the ecosystem and humans The scale and geographic distribution of such climate-induced changes may have an impact on our ability to expand food production to meet the population's needs. As a result, climate change may have far-reaching implications for international trade patterns, development, and food security. In recent years citizens in Solapur experiencing weather changes like. Hot summers, water scarcity, erratic rainfall, etc. which is not a usual event. Climate change shows its impact on agriculture, food storage, and food supply sector. Agriculture is the backbone of the Indian economy, suffering from climate change issues. It is necessary to investigate regional climate change issues to check the impact on local agriculture, food storage, and food supply to control loss. Agriculture is affected by short-term weather changes as well as seasonal, yearly, and long-term climate variations. Crop yield is the result of many different factors. Crop yield is influenced by factors such as soil, seed, pests and diseases, fertilizers, and agronomic methods. Pest harborages is also influenced by local climate change affecting crop yield The growing population, combined with human-caused climate change and environmental issues, is proving to be a growing burden. In similar work. There is fluctuation in trend in maximum and minimum temperature and relative humidity in Kwara state of Nigeria (1). The climatic variability found over Kalahandi,

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Bolangir and Koraput (hereafter KBK) districts in the state of Odish (2). An increasing trend in temperature at Sanliurfa, Turkey (3) .There is decreasing trend in annual, seasonal and monthly rainfall after analyzing 57 years of rainfall data of Solapur district(4). The Rainfall Variability trend in Solapur District of Maharashtra there is increasing trend of rainfall toward the Barshi, Akkalkot North and South Solapur and decreasing towards the Malshiras, Karmala, Mohol and Pandharpur tehsils(6). In view of above, this study was undertaken to detect the changing trends in the average annual series of rainfall, temperature and humidity data which will be helpful for agricultural planning and in devising the location specific climate change mitigation and adaptation strategies.

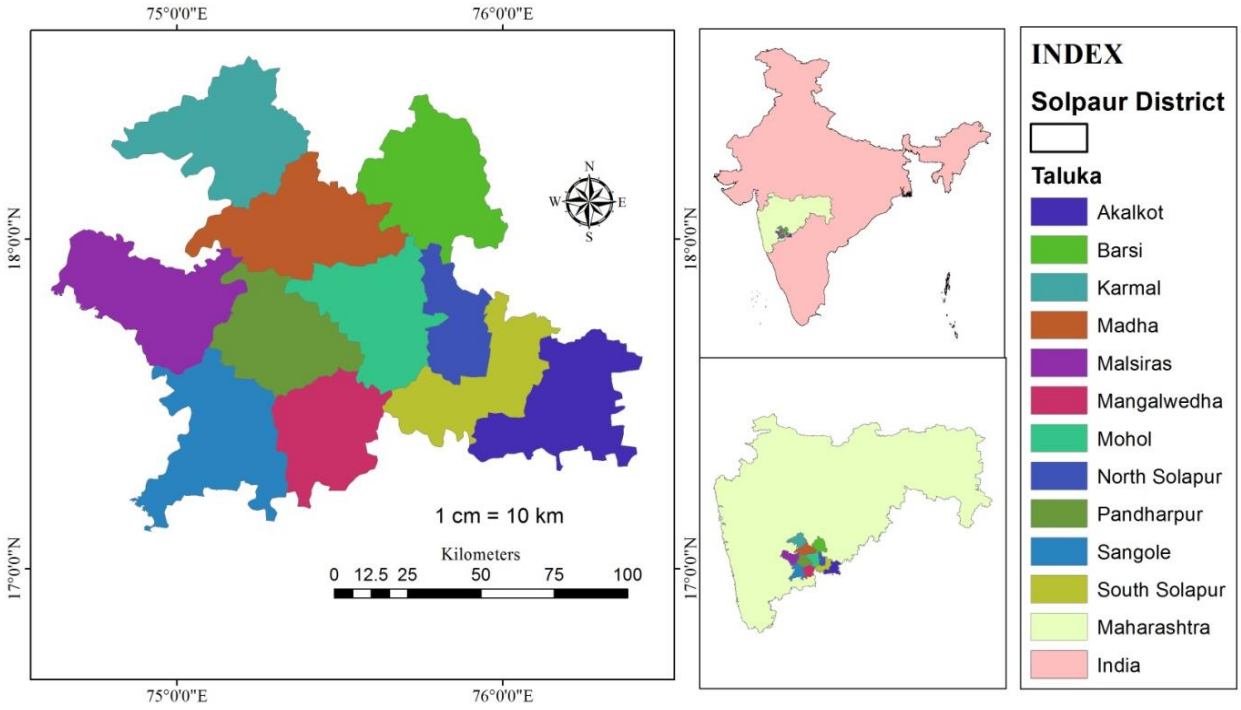

Fig. 1 Location map of Solapur, Maharashtra and India

2. Study area:

Geographical location of Solapur is 17.10 to 18.32 degrees north latitude and 74.42 to 76.15 degrees east longitude. The district is situated on the direction of Maharashtra State.

The district has flat or undulating terrain. The district covers geographical area of 14844.6 sq.kms. Which is 4.82% of the total area of Maharashtra State. Out of the total area of the district 338.8 sq.kms (2.28%) is urban area whereas remaining 14505.8 sq.kms. (97.72%) is rural area. Area wise Karmala taluka is biggest covering an area of 1609.7 sq.kms and North Solapur is smallest covering an area of 736..3 sq.kms

3. Data and processing:

Temperature precipitation and relative humidity data over the last 30 years were acquired from the Indian Meteorological Department, Pune. The available data of maximum and minimum temperature were converted into average monthly maximum temperature and monthly minimum temperature and monthly rainfall and humidity data were converted into annual average rainfall annual average maximum and minimum temperature and annual average relative humidity data. Data was analyzed by using Mann-Kendall trend test by using XLSTAT software to check positive or negative trend and MS-excel to perform regression analysis to check variance in data. Location map was created by using ARC-GIS software.

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Table no.1 showing Mann-Kendall test observations and interpretation of average annual temperature, rainfall and humidity parameters of Solapur district

Parameter	Mann-Kendall statistic(S)	Mann-Kendall's tau	Variation (S)	P value-one tailed	Alpha	Test interpretation
Average. Annual max. Temperature.	257	0.553	3461.667	<0.0001	0.001	Reject H_0
Average. Annual minimum. temperature	57	0.123	3361.667	0.341	0.001	Accept H_0
Average Annual Rainfall	-19.000	1	3461.667	0.620	0.001	Accept H_0
Average Annual Maximum Relative humidity%	-207	-0.445	3456.667	0.00046	0.05	Reject H_0
Average Annual Minimum Relative humidity%	-40	-0.086	3456.667	0.507	0.05	Accept H_0

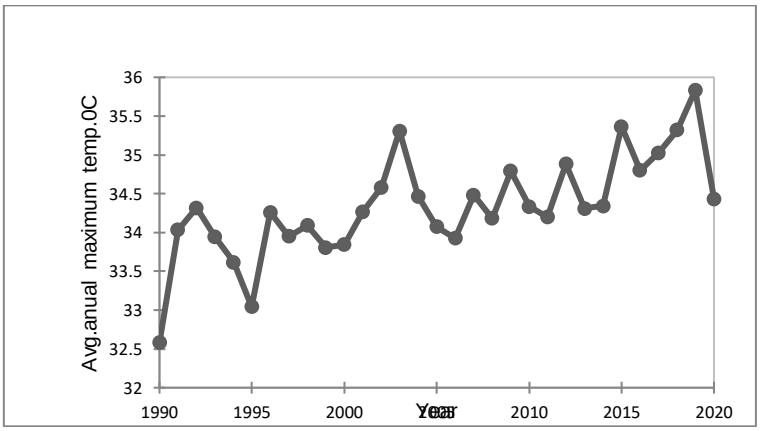

Fig. 2 Average annual maximum temperature trend of Solapur district

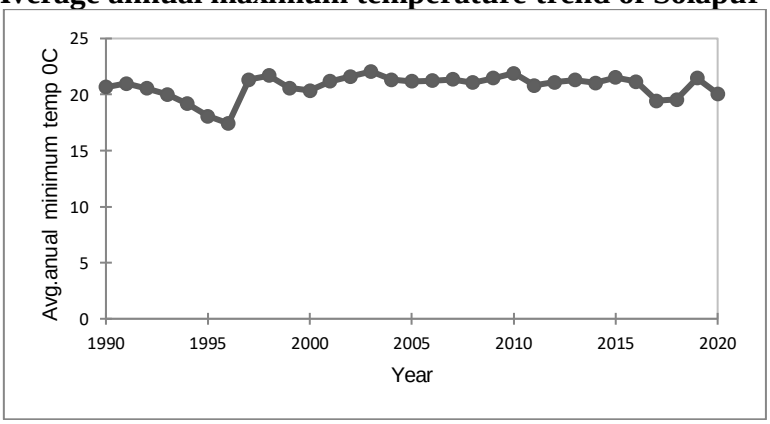

Fig. 3 Average annual minimum temperature trend of Solapur district

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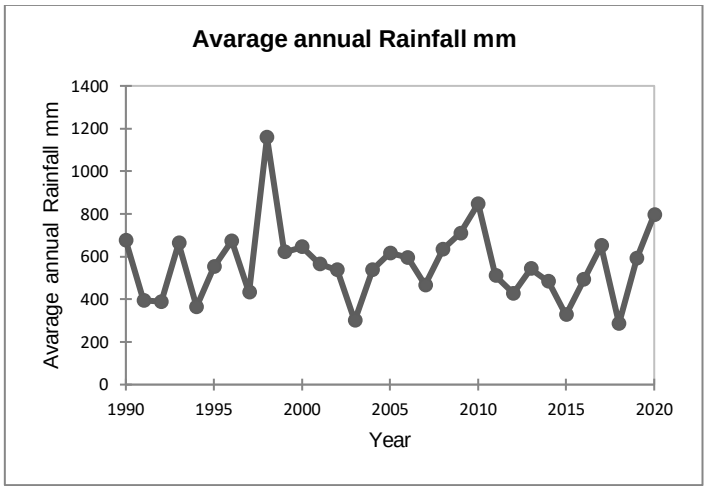

Fig. 4 Average annual rainfall trend of Solapur district

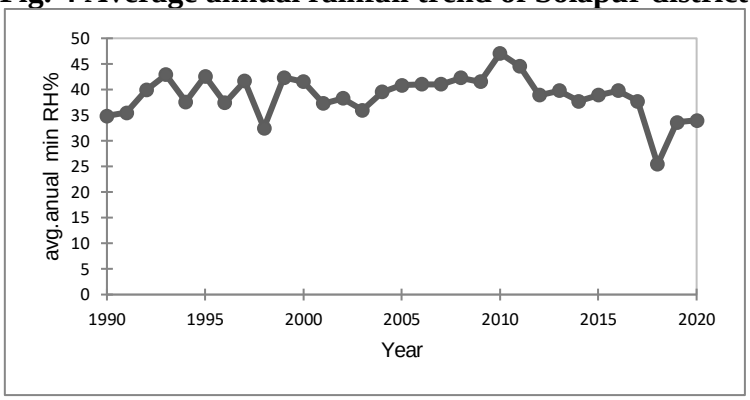

Fig. 5 Average annual minimum Relative humidity trend of Solapur district

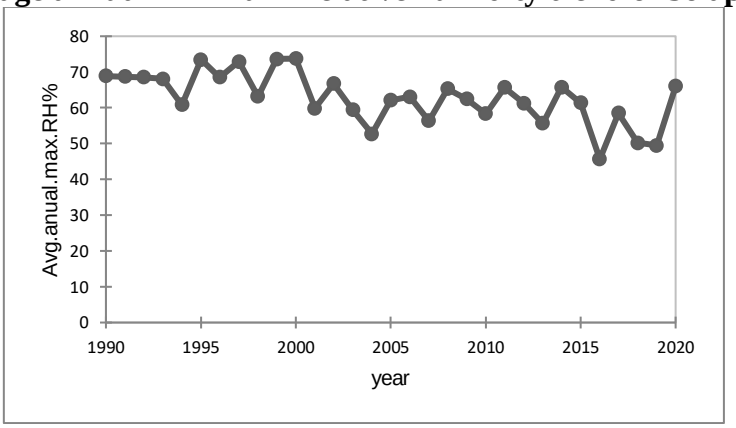

Fig. 6 Average annual maximum Relative humidity trend of Solapur district

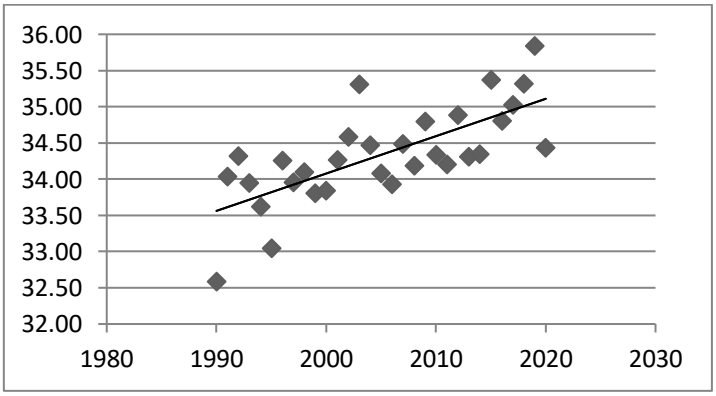

Fig. 7 Linear regression of Average annual maximum temperature trend of Solapur district

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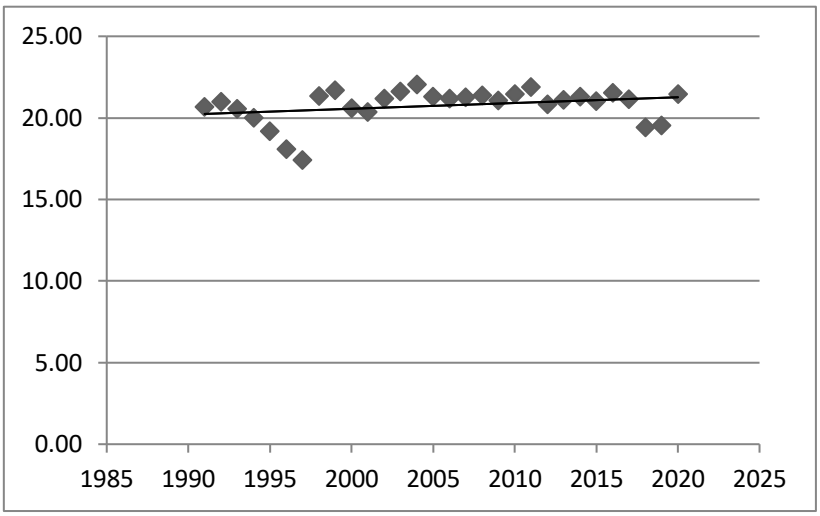

Fig. 8 Linear regression of Average annual minimum temperature of Solapur district

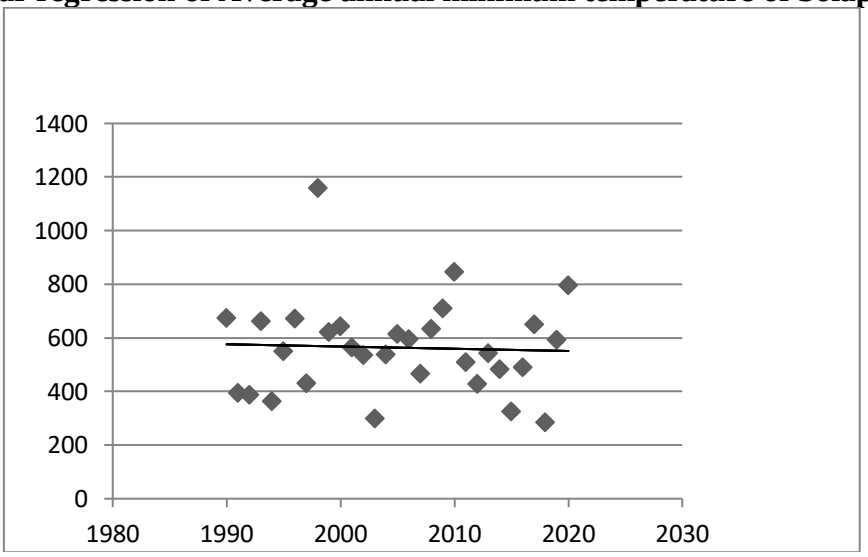

Fig. 9 Linear regression analysis of average annual rainfall of Solapur district

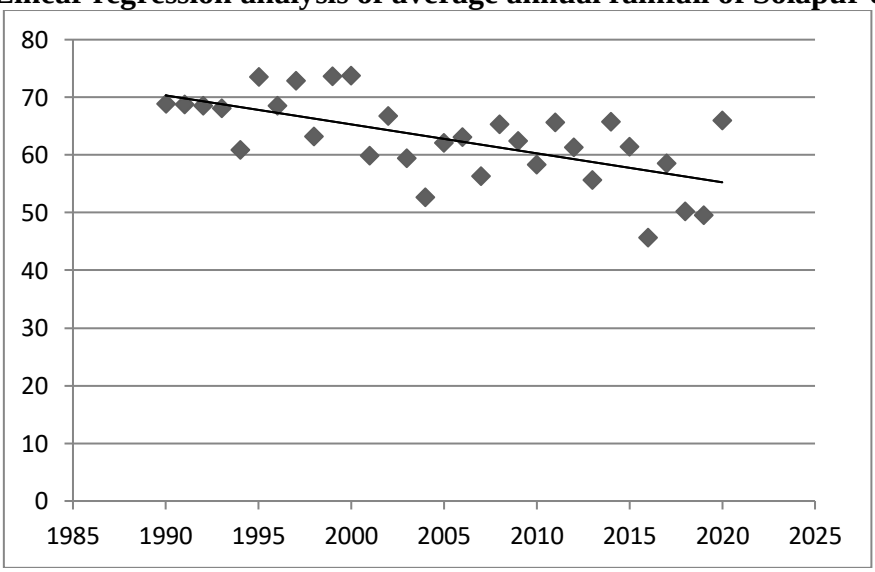

Fig. 10 Linear regression analysis of average annual maximum relative humidity of Solapur district

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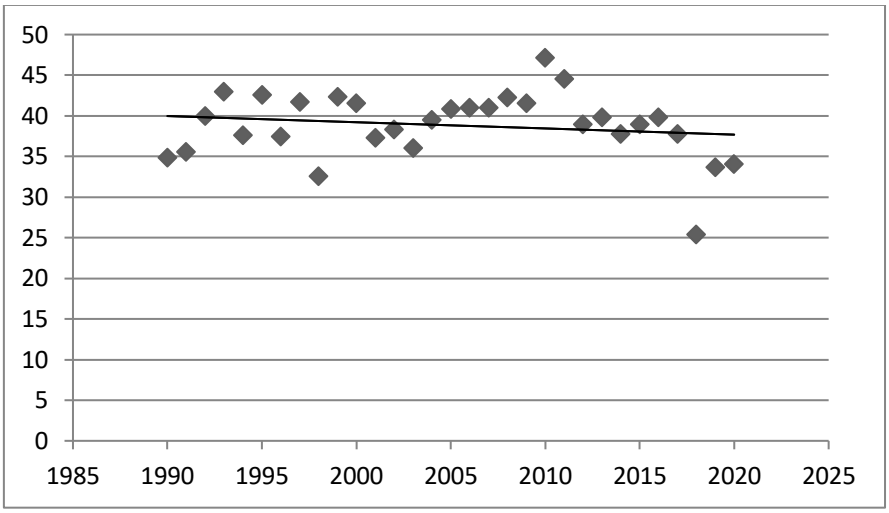

Fig. 11 linear regression analysis of average annual minimum relative humidity of Solapur district

Table no. 2 showing Results of regression analysis of average annual temperature, rainfall and humidity of Solapur district

Sr. no.	Parameter	Equation	Value of R^2
1	Average annual maximum temperature	$Y = 0.0516X - 69.117$	$R^2 = 0.5055$
2	Average annual minimum temperature	$Y = 0.0352X - 49.934$	$R^2 = 0.0835$
3	Average annual rainfall	$Y = 0.8353X + 2238.4$	$R^2 = 0.0018$
4	Average annual maximum relative humidity	$Y = 0.5021X + 1069.6$	$R^2 = 0.4$
5	Average annual minimum relative humidity	$Y = 0.0763X + 191.73$	$R^2 = 0.0284$

4. Results and discussion:

4.1.The overall results shows climate of Solapur is fall under semi-arid with mean annual rainfall of about 563mm.out of which 80-90% is received during June to September i.e. on avarage115.86mm. During October to January on average 32.45mm of rainfall is being received and during February to May 7.83mm of rainfall is being received.

4.2. The overall study shows Average maximum temperature is appears in the month of April and May. Highest maximum temperature is observed in May month i.e. 43.59^0c.Whereas Average minimum temperature is observed in month of February i.e. 11.22^0c and average lowest minimum temperature is observed in month of December i.e.11.75^0c.Avarage maximum temperature ranging from 31.1 to 40.25^0c.Avarage minimum temperature ranging from 11.22 to 25.11^0C.Avarage temperature is 27.53^0C.avarage highest relative humidity ranging from 60.83 to 73.75 % and average annual minimum humidity ranging from 25.4 to 47.08%.highest relative humidity in the year found in June, July, August, September, October. Low humidity is found in February, March, and April. And remaining month shows moderate range i.e.50-60% of humidity.

4.3. Table number 2 and Fig number 7, 8,9,10 and 11 shows Result of linear regression study reveals that there is highest variance in average annual maximum temperature and average annual maximum humidity. I.e. closely fit to regression model. Whereas Average annual rainfall, average annual minimum temperature and average annual minimum relative humidity shows less variance in data i.e. less fit to regression model.
4.4. Table number 1 and Fig number 2, 3,4,5,6 shows results of Man-Kendall test shows that Annual maximum temperature shows increasing trend and average annual maximum humidity showing decreasing trend. There is no trend showing in Average anual minimum temperature, Average annual minimum humidity and Average annual rainfall pattern.

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