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Long Term Monthly and Inter-Seasonal Weather Variability Trend Analysis of Bastar Plateau Zone of Chhattisgarh

ORIGINAL ARTICLE

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Abstract

The set of meteorological data collected from CARS Jagdalpur Bastar plateau zone of Chhattisgarh were analyzed to obtain trend analysis of various weather parameters. It indicated that maximum temperature has shown significant change in months of August, October, November and December and in seasons of kharif and southwest monsoon. Minimum temperature and diurnal temperature range results have not shown any significant changes over the years. The analysis of morning relative humidity shown significant increase in RH in january, feburary, march, april and overall annually while only for seasons summer and northeast monsoon RH increased significantly and afternoon RH shown significant increase only in summer season. Wind speed results revealed that wind speed decreased significantly in monthly, seasonal as well as annual analysis. During rainfall analysis, it was seen that there is significant increase of rainfall annually and in months of june, august and September and in seasonal analysis, only southwest monsoon rainfall increased significantly. Similarly, rainy days increased significantly for the months of june, august and september and annually. In seasonal analysis, southwest monsoon and kharif season rainy days increased significantly. The analysis of evaporation showed significant decrease annually and for winter season only. Sunshine hourse when anlysed it was seen that there is significant decrease in sunshine hours on monthly basis. Seasonal analysis, reported significantly decreased in sunshine hours and for kharif and rabi period sunshine hours reported significantly decreased. Overall it was found that there is significant increase in morning relative humidity, rainfall and rainy days while there is significant decrease in wind speed, evaporation and sunshine hours in Buster plateau zone.

Key Words

Maximum temperature, Rainfall, Relative humidity, Bastar plateau.

Introduction

Weather analysis and its study is now one of the most important factor for survival. Our atmosphere is severely gets affected by anthropogenic & manmade attributes. The goal of weather prediction is to provide information to people by which organizations can reduce weather-related-losses and enhance societal benefits, including protection of life, public health and safety and support to economic prosperity. Adverse affect in climate have risen the temperatures in last 30 years and during the period of 2001 to 2010 was the warmest decade ever recorded. Heat waves happen when a region experiences very high temperatures for several days and nights. Greenhouse gases are trapping more heat in the Earth's atmosphere, which is causing average temperatures to rise all over the world. Risks are projected for the near-term (2021–2040), the mid (2041–2060) and long term (2081–2100), at different global warming levels and for pathways that overshoot 1.5°C global warming level for multiple decades (IPCC, 2022). Global warming reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans. Adverse impacts from tropical cyclones, with related losses and damage, have increased due to sea level rise and the increase in heavy precipitation. Climate change including increase in frequency and intensity of extremes has reduced food and water security, hindering efforts to meet Sustainable Development Goals. Between 2010–2020, human mortality from floods, droughts and storms was 15 times higher in highly vulnerable regions, compared to regions with very low vulnerability (IPCC, 2022).

Weather conditions regulate the growth and yield of crops, especially in rain-fed agricultural systems. Agriculture is contributing 21% to the country's GDP, employing 56.4% of the total workforce and supporting 600 million people directly and indirectly (Beena Shah 2010). Directly or indirectly weather variability affects the crops and yield in long run. In this present paper, attempt has been made to analyse the weather variability parameters over 30 years of time period in Bastar plateau zone of Chhattisgarh.

Data and Methodology

The daily meteorological data (1991-2021) for the different weather parameters was taken from the Agrometeorological Field Unit Bastar Plateau zone. Climate variability analysis was carried out by analysing daily historical data of different meteorological parameters (maximum temperature, minimum temperature, rainfall, rainy days, sunshine hours, wind speed, relative humidity and evaporation) for about 30 years on annual, monthly and seasonal basis. The annual, monthly and seasonal data was analyzed using the linear regression method with the help of MS excel. From regression analysis of monthly, annual and seasonal trends of different weather parameters have positive as well as negative trends during the 30 year period of time.

Results and Discussion

Annual, Monthly and Seasonal Variability Trends

The results obtained from regression analysis of monthly, annual and seasonal trends of different weather parameters have positive as well as negative trends during the 30 year period of time. These results have been analysed and discussed. Annual weather parameters of 30 years of Bastar plateau zone is shown by graphical representation.

Maximum Temperature

The slope and regression equations for annual, monthly and seasonal maximum, minimum and diural temperature have been shown in table 1. The normal annual, monthly, kharif, rabi, winter, summer, southwest monsoon and northeast monsoon maximum temperature of Bastar plateau region is 31.0, 27.3 to 37.5, 29.7, 28.4, 29.4, 36.3, 29.7 and 28.6p C respectively. It has been found that maximum temperature over the period has increased significantly only for the months august, October, November and December. The highest maximum temperature was in month may and lowest was for month December. The maximum temperature was found to be increasing for the months January, feburary, july and september but was not significant while

for months march, april, may and june maximum temperature found to be decreasing non-significantly. However, during summer (March, April, May and June) is not showing any significant increasing trends indicating no effect of global warming at this regional level possibly due to having dense forested area according to the study of G.K. Sharma *et.al* 2014.

The seasonal analysis of maximum temperature shows significant increase in temperature for southwest monsoon by 0.043p C while for seasons winter and northeast monsoon maximum temperature increased non-significantly and for summer decreased but non-significantly. For kharif and rabi seasons, maximum temperature significantly by 0.036p C in rabi season, while for kharif maximum temperature increased but was not significant. Overall annual maximum temperature was not significant but found to be increasing.

Minimum Temperature

The normal minimum temperature of central Bastar plateau region ranges from 9.7 to 24.5p C for different months and 18.4p C annually. The analysis of minimum temperature over 30 years period suggests that for none of the months minimum temperature changed significantly. Although for most of the months like januray, feburary, march, april, july, august, october, november and december minimum temperature decreased but was not significant while for months may, june and September minimum temperature increased but was not significant. As a result, we see annual minimum temperature decreased at the rate 0.004p C, but non-significantly. Further, number of days having the threshold values of less than 10 degree centigrade are indicating increasing pattern which can have wide ranging effects on the rabi cropping particularly in Kondagaon and Bastar districts of this tribal belt. Further studies in Bastar region at regional level will help in developing sustainable crop pattern since temperature is 3.4. Month wise minimum temperature not a limiting factor as far as expansion of acreage in rabi season and provision of irrigation are concerned. Similar study was done by G.K Sharma *et.al* 2014. However, number of days under different ranges of maximum temperature (greater than or equal to 40, 41, 42, 43, 44, 45 and 46 degree centigrade) during summer (March, April, May and June) are not showing any increasing trends indicating no effect of global warming at this regional level possibly due to having dense forested area. Similar studies done by Ramteke *et al.* (2021) where he found that the maximum and minimum temperatures during peak summer and winter touches 37.4°C and 10.0°C, respectively.

During seasonal analysis also we found that for all seasons minimum temperature decreased but was not significant. During rabi period minimum temperature increased at the rate 0.006p C but was not significant while in kharif period we see similar trend i.e. it decreased by 0.001p C but was not significant.

Diurnal Temperature Range

Diurnal temperature range (DTR) is an indicator associated with global climate chamge which is defined as difference between daily maximum and minimum temperature, which describes the within-day temperature variability and reflects weather stability. The normal diurnal temperature ranges from 18.5 to 31p C for Bastar plateau region of Chhattisgarh of different months. All months except feburary to june diural temperature increased but non-significantly. Due to this result we see annual diural temperature also increased by 0.003p C but non-significantly. In seasonal analysis, for winter and summer season diural temperature decreased while for seasons southwest and northeast monsoon it increased but for all seasons it was not significant. During kharif and rabi period also diural temperature range increased by 0.007p C and 0.021p C respectively but was not significantly.

Table 1: Trend analysis of temperature for different time period of the year (1991-2021)

	Maximum Temperature			Minimum temperature			Diurnal temp.range		
Month	**Normal**	**Equation**	**R^2**	**Normal**	**Equation**	**R^2**	**Normal**	**Equation**	**R^2**
January	28	y = 0.015x + 27.75	0.007	10.3	y = -0.006x + 10.42	0.000	19.2	y = 0.004x + 19.09	0.0
Feburary	30.9	y = 0.010x + 30.71	0.005	12.9	y = -0.051x + 13.74	0.105	21.9	y = -0.020x + 22.23	0.037
March	34.7	y = -0.032x + 35.15	0.068	17.5	y = -0.018x + 17.73	0.017	26.1	y = -0.025x + 26.44	0.069

April	36.6	y = -0.015x + 36.88	0.007	21.8	y = -0.032x + 22.26	0.050	29.2	y = -0.023x + 29.57	0.03
May	37.5	y = -0.025x + 37.89	0.019	24.5	y = 0.015x + 24.22	0.002	31.0	y = -0.004x + 31.05	0.0
June	32.6	y = -0.012x + 32.80	0.003	23.4	y = 0.002x + 23.40	0.000	28.0	y = -0.004x + 28.10	0.001
July	28.6	y = 0.013x + 28.35	0.013	22.5	y = -0.002x + 22.25	0.000	25.6	y = 0.001x + 25.51	0.0
August	28.1	y = 0.045x + 27.33	**0.157***	22.2	y = -0.002x + 22.25	0.000	25.2	y = 0.021x + 24.79	0.047
September	29.5	y = 0.016x + 29.24	0.024	22	y = 0.003x + 21.96	0.000	25.8	y = 0.009x + 25.60	0.011
October	29.8	y = 0.035x + 29.25	**0.168***	19.3	y = -0.007x + 19.50	0.002	24.6	y = 0.013x + 24.37	0.029
November	28.6	y = 0.045x + 27.91	**0.192***	14.3	y = -0.005x + 14.45	0.000	21.5	y = 0.019x + 21.18	0.021
December	27.3	y = 0.048x + 26.57	**0.134***	9.7	y = 0.045x + 8.938	0.031	18.5	y = 0.046x + 17.75	0.097
Annual	31.0	y = 0.012x + 30.81	0.045	18.4	y = -0.004x + 18.46	0.001	24.7	y = 0.003x + 24.63	0.003
Kharif	29.7	y = 0.015x + 29.43	0.033	22.5	y = -0.001x + 22.57	0.00	26.1	y = 0.007x + 26.00	0.006
Rabi	28.4	y = 0.036x + 27.87	**0.213****	13.4	y = 0.006x + 13.33	0.001	21	y = 0.021x + 20.60	0.054
Winter	29.4	y = 0.012x + 29.18	0.010	11.6	y = -0.027x + 12.00	0.023	20.5	y = -0.007x + 20.59	0.003
Summer	36.3	y = -0.023x + 36.62	0.050	21.2	y = -0.027x + 12.00	0.006	28.8	y = -0.023x + 36.62	0.050
Northeast monsoon	29.7	y = 0.016x + 29.40	0.036	22.5	y = -0.027x + 12.00	0.00	26.1	y = 0.026x + 21.11	0.07
Southwest monsoon	28.6	y = 0.043x + 27.91	**0.244****	14.4	y = -0.027x + 12.00	0.003	21.5	y = 0.016x + 29.40	0.036

*Significance at 5% level of significane
** Significance at 1% level of significane

Morning Relative Humidity

The weather variability analysis of moring and evening Rh is shown in table 2. The normal morning relative humidity of Bastar plateau region of Chhattisgarh is 85.8%. The morning relative humidity during monthly analysis in this region ranges between 69 to 92% being lowest for month may and highest for months September, October, November and January. During the monthly analysis it was found that morning relative humidity increased significantly in the months of January, February, march april and may by 0.173%, 0.385%, 0.721%, 0.581% and 0.492% respectively while for rest of the months except august morning relative humidity increased but was significant.

The results of kharif and rabi period morning RH increased by 0.109% and 0.062% respectively but non-significantly. For seasons summer and northeast monsoon morning RH increased significantly by 0.584% and 0.281% respectively while for seasons winter and southwest monsoon morning RH increased but was not significant.

Evening Relative Humidity

The normal evening relative humidiy of Bastar plateau region is 49.8%. The mean monthly evening relative humidity in this region ranges from 30 to 76% being lowest for month march and may and highest for month august. In monthly analysis, it was found that there is not any significant changes in RH but for most of the months except july august, October and November evening RH increased but was not significant.

The annual evening RH also increased by 0.131% but was not significant. Also for kharif and rabi time period evening RH increased but non-significantly. But for only summer season evening RH increased significantly by 0.361% and for rest of the seasons evening RH increased but was not significant.

Wind Speed

Wind speed describes how fast the air is moving past a certain point and is usually measured as km per hour. Wind speed and direction are important for monitoring and predicting weather patterns and global climate and it mainly affect rates of evaporation, mixing of surface waters, and development of storms. The slope and regression equation of coefficient for long term monthly and seasonal analysis of wind speed is shown in table 2. The annual normal wind speed of Bastar plateau region of Chhattisgarh is 4.9 km/hr. During monthly analysis it revealed that wind speed ranges from 2.7 to 7 km/hr in which wind speed was lowest in December month while highest was found in july month. The results of wind speed over 30 years analysis is tabulated in table no.2. It revealed that wind speed significantly decreased from January to December except in april by 0.112, 0.118, 0.11, 0.1, 0.18, 0.116, 0.118, 0.129, 0.106, 0.106, 0.079 km/hr due to which annual wind speed also shown decreasing trend by 0.111km/hr.

Among seasonal analysis, all seasons i.e winter, summer, northeast and southwest monsoon wind speed decreased significantly by 0.114, 0.09, 0.097, 0.136 km/hr respectively. In kharif and rabi time period also wind speed significantly decreased by 0.136 and 0.101 km/hr respectively. Overall wind speed parameter found to be decreasing significantly in Bastar plateau region over 30 years of time period.

Table 2: Trend analysis of relative humidity and wind speed for different time period of the year (1991-2021)

	Morning RH			Evening RH			Wind speed		
Month	**Normal**	**Equation**	**R^2**	**Normal**	**Equation**	**R^2**	**Normal**	**Equation**	**R^2**
January	92	y = 0.173x + 88.87	**0.174***	40	y = 0.006x + 39.70	0.0	3.3	y = -0.112x + 5.121	**0.231****
Feburary	88	y = 0.385x + 81.71	**0.299****	34	y = 0.194x + 31.36	0.026	3.8	y = -0.118x + 5.677	**0.422****
March	79	y = 0.721x + 67.71	**0.504****	30	y = 0.425x + 22.81	0.106	4.5	y = -0.11x + 6.231	**0.277****
April	73	y = 0.581x + 63.76	**0.342****	31	y = 0.366x + 24.64	0.109	5.8	y = -0.061x + 6.773	0.070
May	69	y = 0.492x + 60.89	**0.238****	34	y = 0.279x + 29.84	0.066	6.5	y = -0.100x + 8.095	**0.277****
June	81	y = 0.219x + 77.33	0.089	58	y = 0.265x + 54.03	0.055	7.5	y = -0.180x + 10.40	**0.252****
July	90	y = 0.030x + 89.83	0.013	74	y = -0.008x + 73.98	0.0	7	y = -0.116x + 8.820	**0.331****
August	90	y = -0.053x + 90.69	0.001	76	y = -0.061x + 76.85	0.010	6	y = -0.118x + 7.889	**0.395****
September	92	y = 0.053x + 90.81	0.036	70	y = 0.017x + 69.78	0.0	4.6	y = -0.129x + 6.666	**0.204****
October	92	y = 0.093x + 90.6	0.048	59	y = -0.066x + 60.39	0.004	3.6	y = -0.106x + 5.229	**0.236****
November	92	y = 0.084x + 91	0.053	49	y = -0.038x + 49.71	0.00	3.2	y = -0.106x + 4.922	**0.276****
December	91	y = 0.085x + 90.01	0.012	43	y = 0.281x + 38.16	0.026	2.7	y = -0.079x + 3.995	**0.161***
Annual	85.8	y = 0.241x + 81.91	**0.329****	49.8	y = 0.131x + 47.69	0.039	4.9	y = -0.111x + 6.645	**0.459****
Kharif	88.3	y = 0.109x + 90.12	0.071	69.5	y = 0.053x + 68.66	0.007	6.3	y = -0.136x + 8.445	**0.440****
Rabi	91.8	y = 0.062x + 87.17	0.014	47.8	y = 0.045x + 46.99	0.002	3.2	y = -0.101x + 4.817	**0.311****
Winter	90	y = 0.087x + 90.47	0.031	37	y = 0.101x + 35.6	0.007	3.5	y = -0.114x + 5.363	**0.341****
Summer	74	y = 0.584x + 64.29	**0.448****	32	y = 0.361x + 25.8	**0.138***	5.6	y = -0.090x + 7.032	**0.251****
Northeast monsoon	88	y = 0.281x + 85.29	**0.281****	70	y = 0.060x + 49.41	0.002	6.3	y = -0.097x + 4.709	**0.230****
Southwest monsoon	92	y = 0.062x + 87.16	0.014	50	y = 0.044x + 68.81	0.005	3.2	y = -0.136x + 8.448	**0.442****

*Significance at 5% level of significance

** Significance at 1% level of significance

Rainfall

The rainfall analysis was done by analyzing daily, monthly, annual and seasonal basis by variability trends and is shown in table no.3. The annual normal rainfall of Bastar plateau region of Chhattisgarh over 30 years is 1441.6 mm. Similar studies were done by Bhuarya *et.al* (2018) where in districts in Dantewada, Bijapur, Narayanpur, Bastar, Koiya, Surguja districts and some parts of Raigarh, Jaspur 1400- 1600 mm rainfall observed.

The normal rainfall during different months ranges from 7.4 to 354.3 mm being lowest for december and highest for august month. The annual rainfall pattern showed significantly increasing trend of rainfall by 18.7 mm per year. Study done by R. khavse *et.al* 2022 observed that total annual rainfall increased @ 2.603 mm/ year during the last 35 years (1980-2014) in Jagdalpur station which indicates that trend lines for total rainfall in the rainy season during June to September were increasing.

In monthly analysis results showed that for months june, august and September rainfall significantly increased by rate of 4.557, 5.045, 5.648 mm respectively. In other months like February, April, July and October rainfall increased but non-significantly and for months January, march, may, November and December rainfall decreased but was not significant.

The trend analysis for different seasons showed significant increase in rainfall only for southwest monsoon by 16.33 mm while for rest of the seasons rainfall increased but non-significantly. During kharif and rabi time period, results revealed that for kharif time rainfall increased significantly by 16.33 mm and for rabi rainfall increased but was not significant.

Rainy Days

The slope and regression coefficients of the equation obtained for monthly, annual and seasonal rainy days over 30 years of Bastar plateau zone is shown in Table 3. The annual normal rainy days of this zone is 76 days which have shown significant increasing trend. The normal rainy day for different months ranges from 1 to 18 days in which lowest rainy day i.e. 1 rainy day has in months January, February, march, November and December and highest number of rainy days was in month august i.e. 18 days. It has been found that rainy days increased significantly in months june, august and September by 0.169mm, 0.121mm and 0.151mm respectively while for other months except feburary and November rainy days has been increased but non-significantly.

The annual rainy days was found to be increased significantly by 0.629 mm per year. Among different seasons of the year, rainy days increased significantly in southwest monsoon season by 0.441mm while for other seasons except winter rainy days increased but was not significant. During kharif and rabi duration rainy days in kharif period was found to be increasing significantly by 0.441mm but for rabi period rainy days increased but was not significant.

Pan Evaporation

The amount of evaporation is a function of temperature, humidity, wind and other ambient conditions. The variability trend analysis of evaporation of Bastar plateau zone of Chhattisgarh over 30 years of time is shown in Table 3. The annual normal evaporation is 1552.0mm which is found to be significantly decreasing by the rate 6.6 mm per year. The normal evaporation for different months ranges from 87.5 mm to 232.9 mm being lowest in December month and highest in month of may.

In monthly analysis, results revealed that for all months i.e from janurary to December evaporation decreased but non-significantly.

During seasonal analysis, evaporation found to be decreasing significantly for only winter season by 1.261mm and for other seasons evaporation decreased but was not significant. For both rabi and kharif period evaporation decreased but non-significantly.

Sunshine Hours

Sunshine duration is the length of time sunlight reaching the earth's surface directly from the sun. The slope and regression coefficients of the equation obtained for monthly, annual and seasonal sunshine hours over 30 years of Bastar plateau zone in Table 3. The annual sunshine hours at this regionis 6.4 hours which is decreasing significantly at rate of 0.049 hours per year. The normal monthly sunshine hours at this region ranges from 2.8 to 8.4 hours being lowest in july and august and highest in February.

During monthly analysis, it was found that for months March, April, May, June, August, September, October, November and December sunshine hours decreased significantly by 0.081, 0.054, 0.058, 0.058, 0.047, 0.042, 0.056, 0.071 hours respectively while for rest of the months sunshine hours decreased but was not significant.

In seasonal analysis also sunshine hours decreased significantly by 0.037, 0.064, 0.055 and 0.040 hours for winter, summer, northeast monsoon, and southwest monsoon respectively. During kharif and rabi time period sunshine hours was again found to be decreasing significantly by 0.052 and 0.041 hours respectively. Sunshine hours over 30 years of time period found to be decreasing.

Table 3: Trend analysis of rainfall, rainy days, and evaporation and sunshine hours for different time period of the year (1991-2021)

	Rainfall			Rainy days			Evaporation			Sunshine hours		
Month	**Normal**	**Equation**	**R^2**	**Normal**	**Equation**	**R^2**	**Normal**	**Equation**	**R2**	**Normal**	**Equation**	**R^2**
January	12.5	y = -0.001x + 12.46	0.0	1	y = 0.003x + 0.819	0.0	101.4	y = -0.769x + 113.6	0.120	7.8	y = -0.039x + 8.432	0.118
Feburary	8.5	y = 0.015x + 8.201	0.000	1	y = -0.009x + 0.993	0.004	122.5	y = -0.491x + 129.9	0.059	8.4	y = -0.037x + 9.029	0.090
March	18.4	y = -0.007x + 17.34	0.0	1	y = 0.006x + 1.245	0.001	182.8	y = -0.654x + 194.4	0.055	7.8	y = -0.081x + 9.080	**0.375****
April	50.5	y = 1.185x + 33.00	0.083	4	y = 0.068x + 3.071	0.062	210.8	y = -0.353x + 216.7	0.010	7.9	y = -0.054x + 8.806	**0.219****
May	72.5	y = -0.316x + 75.38	0.005	5	y = 0.035x + 4.716	0.017	232.9	y = -1.047x + 249.9	0.043	7.7	y = -0.058x + 8.640	**0.189***
June	230	y = 4.557x + 153.2	**0.142***	11	y = 0.169x + 7.941	**0.277****	152	y = -1.147x + 170.8	0.072	4.4	y = -0.058x + 5.343	**0.155***
July	336.7	y = 1.079x + 323.1	0.007	17	y = 0.000x + 16.92	0.0	88.7	y = -0.427x + 95.39	0.029	2.8	y = -0.046x + 3.567	**0.070**
August	354.3	y = 5.045x + 273.6	**0.157***	18	y = 0.121x + 15.61	**0.131***	81.7	y = -0.041x + 82.42	0.000	2.8	y = -0.012x + 2.986	**0.009**
September	226.6	y = 5.648x + 136.0	**0.252***	12	y = 0.151x + 9.187	**0.186***	95	y = -0.360x + 100.7	0.024	4.8	y = -0.047x + 5.571	**0.144***
October	100.1	y = 1.665x + 74.31	0.031	5	y = 0.085x + 3.761	0.053	103.1	y = -0.322x + 108.2	0.023	6.7	y = -0.042x + 7.367	**0.125***
November	24.1	y = -0.156x + 26.63	0.001	1	y = -0.005x + 1.380	0.0	93.6	y = -0.363x + 99.56	0.034	7.4	y = -0.056x + 8.256	**0.226****
December	7.4	y = -0.018x + 7.789	0.0	1	y = 0.002x + 0.535	0.0	87.5	y = -0.611x + 96.54	0.096	7.7	y = -0.071x + 8.850	**0.284****
Annual	1441.6	y = 18.69x+1141	**0.303****	76	y = 0.629x + 66.19	**0.322****	1552.0	y = 18.69x + 1141	**0.303****	6.4	y = -0.049x + 7.136	**0.555****
Kharif	1147.6	y = 16.33x + 885.9	**0.301****	56	y = 0.441x + 49.67	**0.283****	417.4	y = -1.976x + 449.4	0.062	3.7	y = -0.052x + 8.226	**0.376****
Rabi	144.1	y = 1.488x + 121.2	0.021	8	y = 0.085x + 6.496	0.035	385.6	y = -2.066x + 417.9	0.107	7.4	y = -0.041x + 4.367	**0.144***

Winter	21	y = 0.013x + 20.66	0.0	2	y = -0.006x + 1.812	0.001	223.9	y = -1.261x + 243.5	0.141 *	8.1	y = -0.037x + 8.695	**0.143***
Summer	141.4	y = 0.861x + 125.7	0.029	11	y = 0.110x + 9.032	0.085	626.5	y = -2.055x + 661.1	0.059	7.8	y = -0.064x + 8.834	**0.361****
Northeast monsoon	1147.6	y = 1.489x + 108.7	**0.021**	56	y = 0.082x + 5.677	0.034	417.4	y = -1.296x + 304.3	0.065	3.7	y = -0.055x + 8.141	**0.385****
Southwest monsoon	131.6	y = 16.33x + 885.9	**0.301** *	7	y = 0.441x + 49.67	**0.283****	284.2	y = -1.976x + 449.4	0.062	7.3	y = -0.040x + 4.330	**0.140***

Conclusion

The analysis of meteorological data of Bastar plateau zone of Chhattisgarh indicated that maximum temperature has not shown significant change for most of the months except in august, October, November and December where significant increase is as observed. In seasonal analysis also maximum temperature increased significantly during southwest monsoon and in kharif time. Minimum temperature and diurnal temperature range not shown any significant changes over the years. The analysis of morning relative humidity shown significant increase in RH in January, feburary, march, april and overall annual basis while only seasons summer and northeast monsoon RH increased significantly. Evening RH has not shown any significant changes over the years on annual basis but shown significant increase only in summer season. Wind speed decreased significantly on monthly, seasonal as well as annual basis. Rainfall analysis indicates that there is significant increase of rainfall in june, august and September. Annual rainfall and kharif time period rainfall increased significantly. In seasonal analysis, only southwest monsoon rainfall increased significantly. Similarly, rainy days increased significantly for months june, august and September. In seasonal analysis, only southwest monsoon rainy days increased significantly while rainy days also increased significantly in kharif time and annually. The analysis of evaporation showed significant decrease annually and for winter season only. In all season sunshine hours decreased significantly. Overall it was found that there is significant increase in morning relative humidity, rainfall and rainy days while there is significant decrease in wind speed, evaporation and sunshine hours. There is significant decrease of sunshine hours on annual basis and in almost all month except in the month of January, February, July and August.

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