AMOGHVARTA

ISSN : 2583-3189

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

ORIGINAL ARTICLE

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Abstract

Considering the changes in extreme weather events of climate variability, availability of various natural resources are vulnerable and hence an assessment of change detection and trend of monthly, seasonal and annual historical series of different climatic variables of Chhattisgarh Plain Zone have been carried out. Based on daily data analysis, trend analysis was applied in time period from 1991 to 2021. The change point analysis results of meteorological variables indicated different change points from year 1991 to 2021 with significant change points in annual series of maximum, minimum, diurnal temperature, wind speed, evaporation and sunshine hour. The maximum temperature has shown significant increase in the month of August, October, November and during rabi season and northeast monsoon. There is significant increase in minimum temperature during seasons and all months except in the month of January. During monthly analysis of morning relative humidity, significant change was observed in months of January, May, August, November and December and during seasons there is significant decrease in only two seasons i.e. winter and northeast monsoon. The evening RH found significantly decrease in only august month. Wind speed found significantly decreasing trend from the month of February to August and in the seasons of kharif, winter, summer and southwest monsoon. There is only significant change in rainfall and rainy days in the month of September and august respectively. The results of evaporation showed that there is significant decrease in the months of Feburary, March, April, May, September and December while during seasons of kharif, winter, summer and southwest monsoon season the evaporation decreased significantly. Sunshine hourse when found to be decreased significantly in the months of January, February, March, September, October and December while during seasons significant decrease was seen in winter, summer and

northeast monsoon season there was significant decrease in sunshine hours. Overall it was found that there is significant increase in maximum as well as minimum temperatures, while there is significant decrease in wind speed, evaporation and sunshine hours.

Key Words

Maximum Temperature, Rainfall, Evaporation, Relative Humidity, Chhattisgarh Plain Zone.

Introduction

The weather of our atmosphere is severely getting affected by growing industrialisation and due to man's interference in nature's way which somehow has affected the weather that led to alteration of atmosphere. The impacts of climate change include warming temperatures, changes in precipitation, and increase in the frequency or intensity of extreme weather events, and rising sea levels. These impacts threaten our health by affecting the food we eat, the water we drink, the air we breathe, and the weather we experience. Scientists projected that warmer temperatures from climate change will increase the frequency of days with unhealthy levels of ground-level ozone, a harmful air pollutant. Rapid rise in concentration of greenhouse gases, emission of harmful gases like chlorofloro carbons, burning of fossil fuels and other gases through vehicles and industrial activities results in more weather variability and extreme weather event.

According to the Intergovernmental Panel on Climate Change (IPCC AR5, 2014), the global mean temperature may increase up to 4 °C by 2100, and will severely affect the availability of water resources and the water demand across the world. As the warming depends on emissions of GHGs in the atmosphere, the IPCC has projected a warming of about 0.2^0C per decade. Further, surface air temperature could rise between 1.1^0C to 6.4^0C over 21th century (R.Khavse *et.al* 2015). Climate model simulations by Hennessey *et al.*, 1997 and empirical evidences confirm that warmer climates, owing to increased water vapour, lead to more intense precipitation events and therefore increase risks of floods (Intergovernmental Panel on Climate Change (IPCC), 2007). In this present paper, attempt has been made to analyze the weather variability parameters over 30 years of time period for Chhattisgarh plain agro climatic zone of India.

Data and Methodology

The daily meteorological data (1991-2021) for the different weather parameters was taken from the department of Agrometeorology, IGKV Raipur. Climate variability analysis of the of Chhattisgarh plain agroclimatic zone 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 calculation of different seasons, i.e. kharif (June-September), rabi (October-January), winter (January-February), pre-monsoon/ summer (March-May), southwest monsoon (June-September) and post monsoon/northeast monsoon (October-December) with the help of daily weather data. 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

Maximum Temperature

The outcome of analysis annual, monthly and seasonal maximum, minimum and diural temperature have been shown in table 1. The normal annual, monthly, kharif, rabi, winter, pre-monsoon, monsoon and post-monsoon maximum temperature of central Chhattisgarh was 32.8, 27.6 to 41.9, 32.4, 29.7, 29, 38.8, 32.4, 29.7^0 C respectively. The results of this study indicate that maximum temperature has been significantly increased annually by 0.02^0C, which is in accordance with the result of R. khavse *et.al* 2015, where increasing trend in mean maximum temperature and total mean rainfall is confirmed by Mann-Kendall trend test. During monthly

analysis, in the months of august, october and November the highest value of maximum temperature was recorded in the month of may and lowest value was in the month of January. In months of August, October, November maximum temperature increased significantly by 0.042^{0}C, 0.039^{0}C and 0.052^{0}C respectively while in march and may maximum temperature decreased non-significantly.

The seasonal analysis of maximum temperature shows significant increase in seasons of rabi and northeast monsoon by 0.041 and 0.042^{0}C respectively whereas maximum temperature in seasons of kharif, winter and southwest monsoon increases by 0.021, 0.054, 0.065^{0}C respectively and in summer maximum temperature decreased by 0.006 ^{0}C but that was non-significant.

Minimum Temperature

The normal minimum temperature of central Chhattisgarh region ranges from 11.5 to 26.7^{0}C during different months. The analysis of minimum temperature over 30 years period reported that all months except in January, minimum temperature increased significantly for all months. The highest value of minimum temperature in monthly analysis was in month of may (26.7^{0}C) and lowest value was in both December and January month (11.5°C).

During winter, summer, southwest and northeast monsoon seasons the minimum temperature increases significantly by 0.058, 0.074, 0.066 and 0.091^{0}C respectively. During kharif and rabi seasons the minimum temperature increases significantly by 0.073, 0.066, 0.092^{0}C respectively.

Diurnal Temperature Range

Diurnal temperature range (DTR) is an indicator associated with global climate change 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 19.6 to 34.3^{0}C during different months. On monthly basis except months of February, March, May and June, during rest months diurnal temperature was found to be increasing significantly. Analysis of the maximum and minimum temperatures at the regional level by Rupa Kumar *et al*. (1994) showed a significant rise in the maximum temperatures with the minimum temperatures remaining almost stable, leading to increasing trends in DTR over large parts of India.

Among different seasons, diurnal temperature increased significantly during winter and summer seasons by 0.043 and 0.033^{0}C and of southwest and northeast monsoon diurnal range has increased significantly by 0.044 and 0.066^{0}C respectively. The result of annual, kharif and rabi season analysis indicates that diurnal temperature range has increased significantly by 0.047, 0.043, 0.046 ^{0}C respectively.

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	27.6	Y=0.043x + 26.91	0.084	11.5	Y=0.056x + 10.57	0.115	19.6	Y=0.049x + 18.74	**0.166***
Feburary	30.5	Y=0.012x + 30.33	0.006	14.2	Y=0.060x + 13.22	**0.137***	22.4	Y=0.036x + 21.78	0.074
March	35.1	Y=-0.014x + 35.38	0.008	18.4	Y=0.091x + 16.92	**0.429****	26.8	Y=0.038x + 26.15	0.126
April	39.5	Y=0.017x + 39.23	0.011	23	Y=0.075x + 21.82	**0.355****	31.3	Y=0.046x + 30.52	**0.130***
May	41.9	Y=-0.019x + 42.22	0.019	26.7	Y=0.055x + 25.84	**0.246***	34.3	Y=0.017x + 34.03	0.027
June	37.1	Y= 37.12	0	26.4	Y=0.057x + 25.43	**0.175***	31.8	Y=0.028x + 31.28	0.026
July	31.4	Y= 0.015x + 31.11	0.016	24.6	Y=0.072x + 23.46	**0.615****	28.0	Y=0.043x + 27.29	**0.254****
August	30.2	Y=0.042x + 29.50	**0.202***	24.5	Y=0.073x + 23.32	**0.616****	27.4	Y=0.058x + 26.41	**0.446****
September	31.2	Y=0.026x + 30.79	0.083	24.3	Y=0.062x + 23.28	**0.592****	27.8	Y=0.044x + 27.04	**0.336****

October	31.4	Y=0.039x + 30.72	**0.142***	21.2	Y=0.074x + 20.01	**0.319****	26.3	Y=0.056x + 25.37	**0.416****
November	29.9	Y=0.052x + 29.02	**0.251***	15.5	Y=0.090x + 14.08	**0.235****	22.7	Y=0.071x + 21.55	**0.374****
December	27.8	Y=0.034x + 27.26	0.074	11.5	Y=0.111x + 9.729	**0.308****	19.7	Y=0.072x + 18.49	**0.352****
Annual	32.8	Y=0.020x + 32.46	**0.156***	20.1	Y=0.073x + 19.00	**0.703****	26.5	Y=0.047x + 25.73	**0.592****
Kharif	32.4	Y=0.021x + 32.13	0.046	24.9	Y=0.066x + 23.87	**0.575****	28.7	Y=0.043x + 28.00	**0.330****
Rabi	29.7	y= 0.042x + 28.48	**0.273****	16.1	Y=0.092x + 14.61	**0.432****	22.9	Y=0.046x + 27.98	**0.431****
Winter	29	Y=0.029x + 28.52	0.054	12.8	Y=0.058x + 11.83	**0.221****	20.9	Y=0.043x + 20.18	**0.199***
Summer	38.8	Y=-0.006x + 38.94	0.003	22.7	Y=0.074x + 21.53	**0.497****	30.8	Y=0.033x + 30.24	**0.148***
Southwest monsoon	32.4	Y=0.021x + 32.10	0.065	24.9	Y=0.066x + 23.86	**0.581****	28.7	Y=0.044x + 27.98	**0.332****
Northeast monsoon	29.7	Y=0.042x + 28.99	**0.234****	16.1	Y=0.091x + 14.62	**0.429****	22.9	Y=0.066x + 21.81	**0.546****

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

Morning Relative Humidity

The normal morning relative humidity at Chhattisgarh plain zone is 79.7%. The morning relative humidity during monthly analysis in this region ranges between 49 to 92% being lowest in the month of may and highest in month of august and September followed by October, November, December, july, January, and feburary. The analysis of long term data of RH indicates that morning relative humidity in the months January, august, November and December showed significant decrease in humidity by 0.174, 0.358, 0.128 and 0.170% per year respectively whereas relative humidity of may month increased significantly by 0.358% per year. The relative humidity during months of feburary, march, april and june increased but was non-significant whereas for months of July, September, October relative humidity decreased but was non-significant.

The results of kharif and northeast monsoon season indicate that the trend of morning relative humidity decreased significantly by 0.119% and 0.127 % per year respectively. During seasons of summer, southeast monsoon and rabi and annually, morning relative humidity increased but was non-significant while in winter season morning relative humidity decreased but was non-significant.

Evening Relative Humidity

The value of normal evening relative humidity in Chhattisgarh plain zone is 44.2%. The mean monthly evening relative humidity in this zone ranges from 21 to 77% being lowest in the month of april and may and highest in the month of august followed by july, september, janurary and feburary. In monthly analysis, it showed that only in the month of august evening relative humidity decreased significantly by 0.127% per year and in rest of the months evening relative humidity increased or decreased but was not significant.

In seasonal analysis, evening relative humidity for winter, rabi and northeast monsoon decreased non-significantly. Annual evening relative humidity increased non-significantly and also same found for summer, kharif and southwest monsoon.

Wind Speed

Evaporation rate is analysed with the help of wind speed parameter. The annual normal wind speed of Chhattisgarh Plain zone is 4.9 km/hr. The result of monthly analysis revealed that wind speed in the months of February to august decreased significantly by 0.029, 0.033, 0.049, 0.095, 0.139, 0.117 and 0.096 km/hr respectively. Similar strong wind speed decrease are observed in the Godvari basin at all the sites in almost all the 12 months as most of the trends are statistically significant at 99% confidence limit was seen by Deepak Jhajharia *et al.*2021

Among seasonal analysis, all seasons except northeast monsoon, wind speed decreased significantly during winter, summer and southwest monsoon by 0.025 km/hr, 0.059 and 0.094 km/hr respectively. The annual and kharif wind speed also decreased significantly by 0.053 and 0.094 km/hr respectively while for rabi wind speed decreased but was non- significant.

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	87	Y=-0.174x + 90.11	**0.199***	36	Y=-0.153x + 38.64	0.033	2.2	Y=-0.021x + 2.585	0.102
Feburary	81	Y=0.039x + 80.61	0.005	33	Y=0.067x + 31.56	0.008	2.9	Y=-0.029x + 3.362	**0.201***
March	70	Y=0.131x + 67.47	0.030	25	Y=0.183x + 22.21	0.057	3.8	Y=-0.033x + 4.321	**0.200***
April	54	Y=0.231x + 50.80	0.069	21	Y=0.096x + 19.03	0.026	5.5	Y=-0.049x + 6.300	**0.205***
May	49	Y=0.358x + 43.29	**0.160***	21	Y=0.207x + 18.00	0.111	7.2	Y=-0.095x + 8.747	**0.377****
June	71	Y=0.234x + 67.44	0.064	47	Y=0.143x + 44.70	0.019	9.4	Y=-0.139x + 11.65	**0.603****
July	89	Y=-0.017x + 89.60	0.003	72	Y=0.054x + 71.58	0.010	8.8	Y=-0.117x + 10.65	**0.315****
August	92	Y=-0.068x + 93.15	**0.206***	77	Y=-0.127x + 78.97	**0.142***	7.4	Y=-0.096x + 8.912	**0.183***
September	92	Y=-0.011x + 92.31	0.009	71	Y=-0.012x + 71.12	0.00	4.6	Y=-0.027x + 4.996	0.034
October	91	Y=-0.058x + 91.90	0.116	54	Y=-0.192x + 57.21	0.055	2.7	Y=-0.014x + 2.965	0.039
November	90	Y=-0.128x + 91.95	**0.298****	39	Y=-0.148x + 41.82	0.035	2.2	Y=-0.013x + 2.46	0.030
December	89	Y=-0.170x + 92.14	**0.330****	35	Y=0.061x + 33.95	0.005	1.9	Y=0.002x + 1.889	0.001
Annual	79.7	Y=0.014x + 79.45	0.003	44.2	Y=0.006x + 44.25	0.0	4.9	Y=-0.053x + 5.747	**0.405****
Kharif	86	Y=-0.119x + 92	**0.335****	66.7	Y=0.014x + 66.59	0.001	7.5	Y=-0.094x + 9.053	**0.373****
Rabi	90	Y=0.034x + 85.62	0.018	42.7	Y=-0.093x + 44.33	0.022	2.3	Y=-0.008x + 2.438	0.022
Winter	84	Y=-0.072x + 85.58	0.033	34	Y=-0.045x + 35.14	0.004	2.5	Y=-0.025x + 2.944	**0.177***
Summer	58	Y=0.227x + 54.10	0.122	22	Y=0.162x + 19.82	0.102	5.5	Y=-0.059x + 6.463	**0.397****
Southwest monsoon	86	Y=0.027x + 85.82	0.011	67	Y=0.005x + 66.78	0.00	7.5	Y=-0.094x + 9.054	**0.369****
Northeast monsoon	90	Y=-0.127x + 92.04	**0.389***	43	Y=-0.092x + 44.32	0.021	2.3	Y=-0.007x + 2.432	0.019

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

Rainfall

The yield of crops is mainly depended on the rainfall analysis. The amount and distribution of rainfall over the area and in specific period of time was done by analyzing daily, monthly, annual and seasonal basis was found out by variability trends. The annual normal rainfall for Chhattisgarh plain zone over 30 years of time is 1202.7 mm. The normal rainfall during different months ranges from 9.5 to 347.8 mm being lowest in the month of November and highest in the month of July. The annual rainfall pattern showed non-significant increasing trend. Similar findings were found by R. Khavse *et.al* 2015, where annual mean rainfall has shown non- significant increasing trend.

In monthly analysis results revealed that there is increase in rainfall in the months of February, May, June, July but it was significant only in September month (5.153 mm per year) while there was non-significant decrease in rainfall in the months of January, march, April, August, October and November. A recent study by using a high resolution daily gridded rainfall data set by Rajeevan *et al.*, (2006) showed that there are significant rising trends in the frequency and the magnitude of extreme rain events over central India during the monsoon season.

The trend analysis of kharif, rabi, winter, summer and southwest monsoon seasons showed non-significant increase in rainfall whereas season of northeast monsoon rainfall showed non-significant decrease in rainfall.

Rainy Days

The slope and regression coefficients of the equation obtained during analysis of monthly, annual and seasonal rainy days with the help of 30 years data of Chhattisgarh plain zone are shown in Table 3. The annual normal rainy days of Chhattisgarh plain zone is 60 days which indicates non-significant decreasing trend. The normal rainy days ranges from 1 to 15 days during different months of the year. In general, rainy days showed a decreasing trend during different months except in February, April, June, September, October and December months. Only for august month rainy days decreased significantly (0.132 mm per year). During different seasons of the year showed non-significant change.

Pan Evaporation

The amount of evaporation is a function of temperature, humidity, wind and other ambient conditions in a given location. The annual normal evaporation of Chhattisgarh plain zone is 1942.7 mm which decreased significantly at the rate of 10.77 mm per year. In monthly analysis, it was found that in the months of feburary, march, april, may and september evaporation decreased significantly by 0.209, 0.209, 0.209, 3.341 and 1.545 mm while for other months there was non-significant changes. Similar results were shown by R.K. Jaiswal *et.al* 2015, where the falling trend of pan evaporation was seen which may be due to strong declining trends in wind speed and falling trend in sunshine hour series on a long term basis.

The significant decrease in evaporation was found in kharif, winter, summer and southwest monsoon seasons by 0.811, 0.133, 6.286, 3.244 mm respectively while for other seasons evaporation decreased but was not significant.

Sunshine Hours

The slope and regression coefficients of the equation obtained for monthly, annual and seasonal sunshine hours over 30 years of Chhattisgarh plain zone are shown in Table 3. The average annual sunshine hours at this region was 6.7 hours which decreased significantly at rate of 0.027 hours per year. The normal monthly sunshine hours at this region ranges from 2.8 to 8.9 hours being lowest in the month of august and highest in the month of april.

In monthly analysis, it was found that in the month of January feburary, march, September, october and December sunshine hours decreased significantly by 0.063. 0.044, 0.060, 0.043, 0.046 and 0.076 hours per year respectively. For rest of the months i.e. April and November sunshine hours decreased and in the months of june, july, august sunshine hours increased but these changes were non significant.

In seasonal analysis, during kharif, winter, summer and northeast monsoon sunshine hours decreased significantly by 0.046, 0.053, 0.028 hours respectively whereas during rabi and southwest monsoon seasons the sunshine hours reported non significant increasing trend.

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	13.5	Y=-0.060x + 14.42	0.0	1	Y=-0.009x + 1.348	0.004	94.8	Y=-0.209x + 98.11	0.033	7.4	Y=-0.063x + 8.413	**0.195***
Feburary	15.5	Y=0.501x + 7.453	0.047	1	Y=0.014x + 1.064	0.008	120.2	Y=-0.209x + 98.11	**0.193***	8.4	Y=-0.044x + 9.137	**0.229****
March	12.5	Y=-0.171x + 15.27	0.010	1	Y=-0.038x + 2.071	0.043	195.6	Y=-0.209x + 98.11	**0.272****	8.5	Y=-0.060x + 9.492	**0.464****
April	18.5	Y=-0.277x + 47.20	0.005	2	Y=0.037x + 1.245	0.042	279.2	Y=-0.209x + 98.11	**0.127***	8.9	Y=-0.021x + 9.208	0.111
May	22.5	Y=0.281x + 17.96	0.016	2	Y=-0.014x + 2.296	0.009	358.3	Y=-3.341x + 411.7	**0.358****	8.6	Y=-0.000x + 8.598	0
June	185.5	Y=0.692x + 174.4	0.002	9	Y=0.046x + 8	0.026	250.8	Y=-2.062x + 283.7	0.117	5.1	Y=0.029x + 4.604	0.056
July	347.8	Y=0.930x + 332.8	0.002	15	Y=-0.051x + 15.69	0.014	127.7	Y=-0.634x + 137.8	0.06	2.9	Y=0.011x + 2.664	0.015
August	318.8	Y=-1.397x + 341.1	0.009	14	Y=-0.132x + 16.24	**0.142***	105.8	Y=0.004x + 105.5	0.0	2.8	Y=0.014x + 2.596	0.032
September	205.7	Y=5.153x + 123.2	**0.202***	10	Y=0.137x + 7.858	0.109	109	Y=-1.545x + 221.4	**0.272***	5.1	Y=-0.043x + 5.851	0.146*
October	42.8	Y=-0.277x + 47.20	0.005	3	Y=0.008x + 2.632	0.001	114.1	Y=-0.21x + 117.4	0.023	7.4	Y=-0.046x + 8.174	**0.173***
November	9.5	Y=-0.121x + 11.45	0.004	1	Y=-0.021x + 0.948	0.037	98.2	Y=-0.032x + 98.73	0.001	7.9	Y=-0.017x + 8.163	0.026
December	10.1	Y=0.593x + 0.624	0.057	1	Y=0.009x + 0.4	0.004	88	Y=-0.051x + 88.86	0.002	7.4	Y=-0.076x + 8.579	**0.235****
Annual	1202.7	Y=6.420x + 1099	0.046	59.6	Y=-0.014x + 59.80	0.00	1942.7	Y=-10.77x + 2115	**0.341****	6.7	Y=-0.027x + 7.124	**0.331****
Kharif	1057.8	y=5.380x + 971.6	0.039	12	Y=0.000x + 11.95	0.0	593.1	y = -3.244x + 645	**0.182***	3.9	Y=-0.046x + 8.305	**0.279****
Rabi	62.4	y = 0.134x + 73.70	0.000	2	Y=-0.000x + 1.326	0.0	300.3	y = -0.502x + 403.1	0.026	7.6	Y=0.003x + 3.929	0.003
Winter	28.9	Y=0.441x + 21.88	0.015	2.5	Y=0.004x + 2.412	0.0	215	Y=-0.949x + 230.1	**0.133***	7.9	Y=-0.053x + 8.755	**0.299****
Summer	53.5	Y=0.404x + 47.04	0.011	5.4	Y=-0.016x + 5.612	0.002	833.1	Y=-6.286x + 934.8	**0.322****	8.7	Y=-0.028x + 9.118	**0.218****
Southwest monsoon	1057.7	Y=5.380x + 971.6	0.039	47.8	Y=0.000x + 47.8	0.0	593.3	Y=-3.244x + 645	**0.182***	4	Y=0.002x + 3.901	0.002
Northeast monsoon	62.4	Y=-0.194x + 59.28	0.001	3.9	Y=-0.002x + 3.980	0.0	300.4	Y=-0.293x + 305.0	0.011	7.6	Y=-0.046x + 8.296	**0.276****

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

Conclusion

The analysis of meteorological data of the region indicated that maximum temperature has not shown anysignificant change for most of the months except significant increase was observed in August, October, November, annually and during northeast monsoon whereas there is significant increase in minimum temperature on annually, during all seasons and in the all months except in the month of January. The analysis of morning relative humidity shown significant decrease in the month of January, August, November and December while for May there is significant increase in RH. In seasonal analysis there is significant decrease in only two seasons i.e. winter and northeast monsoon. Results of evening RH indicates that there is significant decrease of RH in the month of August only. Wind speed also found decreasing significantly on annual basis and in the month of February to August. Whereas, during seasonal analysis winter, summer and southwest monsoon season wind speed found decreasing significantly. During rainfall analysis, it was seen that there is no significant change is seen in the almost all month and seasons except significantly increase is observed in September month. Analysis of rainy days indicates that there is significant decrease was observed in the month of August. The analysis of evaporation shown significant decrease on Annual basis and in the months of February, March, April, May, September and December while during kharif period and during winter, summer and southwest monsoon season the evaporation decreased significantly. It was seen that there is significant decrease in annual sunshine hours and also in months of January, February, March, September, October and December.

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