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SEASONAL DETECTION OF TREND AND VARIABILITY OF CLIMATIC PARAMETERS IN TARAI REGION OF UTTARAKHAND

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Abstract

This present study focuses to analyze the trend and variability seasonally of climatic parameters in tarai region of Uttarakhand. Climatic parameters data over a period of 33 years (1981−2013) has been processed to detect out seasonal trend and variability. The seasonal trends and variability detected here, to achieve the objective which has been shown with 33 years of data. Statistical analysis were carried out, application of parametric statistics tests, regression analysis, coefficient of determination R^2, Q. Q. Plot or Normal plot for seasonal rainfall, trend as general movement of weather parameters over an extended period of time, weather parameters under study were not normally distributed we have calculated median, standard error of median, confidence interval for weather parameters under study and observed seasonally an increasing trend in maximum, minimum temperature, rain fall, rainy days, relative humidity 1412, decreasing trend in relative humidity 712 and wind speed, indicates an increase in maximum temperature is about 0.1934°C, minimum temperature an increase is about 0.0217°C. The relative humidity 1412, an increase is 0.0637%, relative humidity 712, decrease is − 0.0075% and wind speed shows slightly decrease is − 0.0054Km /hour. Rainfall seasonally increases about 0.0319 mm over the region; with slightly increase in rainy days is 0 .0315 days. Quantile-Quantile trend test of monsoon season rainfall, observed skewed to right. Pearson's correlation coefficient was applied to measure degree of relationship between seasonal mean rainy days and seasonal mean rainfall, at α = .01, level of significance (two tailed test) and observed the highly significant positive correlation between seasonal mean rainy days and seasonal mean rainfall. Fluctuations are observed in weather parameters of tarai region of Uttarakhand.

Keywords- Trend analysis, Climatic parameter, Rainfall, Rainy day, Temperature, Q. Q. Plots

I. INTRODUCTION

The weather variables are the most important physical parameters to study the impact of climate change and agricultural metrological information both plays a key role in decision making process of sustainable, agriculture, reduction of natural disaster, heavy rain fall during the period 16th -18th June 2013 in Uttarakhand region, caused loss of lives at a large scale ,landslides and damages of properties, agriculture production, seasonal crops, and economy of farmers, which has emerged as one of the biggest environmental challenges facing the world. Climate change threatens to reverse the gains achieved in human development as droughts, floods, intermittent rainfall and extremes of temperature, among other variables induced by climate change, compromise potential food and income security (Dervis, 2007).Global warming is likely to cause major changes in various weather variables such as temperature, absolute humidity, precipitation and global solar radiation *etc.* (Mimi *et al*., 2010).The air temperature indicates climate changes both on global and regional scale, (Jones *et al*., 1992). The Intergovernmental Panel on Climate Change (IPCC, 2007a) has projected that increase in temperature is expected to be in the range of 1.8 to 4.0°C by the end of 21st Century, for the Indian region (South Asia), the IPCC projected rise in temperature will be 0.5 to 1.2°C by 2020, 0.88 to 3.16°C by 2050 and 1.56 to

5.44°C by 2080, depending on the future human activities (IPCC, 2007b) and the rise in temperature will be higher during the winter season than in the rainy season. Various studies indicated that significant climatic changes are observed over different regions (Sinha *et al*., 1998a).

Natural variability continues to play a key role in weather; climate change has shifted the odds and changed the natural limits, making certain types of extreme weather more frequent and more intense. The kinds of weather events that would be expected to occur more often in a warming world are indeed increasing. Due to chaotic nature of the atmosphere, the massive computational power is required to predict and forecast atmospheric processes (De, *et al*., 2005). In the perspective of climate change, it is significant to establish whether, the characteristics of regional weather conditions are also changing. Climate change is affecting the temperature, as well as rainfall patterns in the densely populated regions that would have enormous significance for livelihood and wellbeing of the people of the region. Climate change will have environmental and social impacts that will likely increase uncertainty in water supplies and agricultural production for people across India. The cascading effects of rising temperatures are already affecting water availability, biodiversity, ecosystem boundaries, and global feedbacks (Amin, *et al*., 2004). The influence of weather and climate on human wellbeing and the inherent impact on the environment are well known. If we know the status of the climate today and the differences between this and recent past, we can begin to plan for the future. There is a need to prepare the people, to anticipate the consequences of climate change and evolve suitable and cost-effective adaptation responses (Tadross, *et al*., 2005).

Changes in variability could greatly differ from season to season, and were highly dependent upon local physical processes (Gregory and Mitchell, 1995). Karl and Easterling (1999) found that during 1951−1990 global day time and daily mean temperature increased by three times as much by 0.28°C while the night time temperature (daily minimum) temperature increased three times as much by 0.84°C.In other words, the warming in daily minimum is stronger than that of minimum temperature. Rao, Murty and Joshi (2005) analyzed that the extreme weather events, such as high and low temperatures, heavy rainfall in connection with the climate change over India and concluded that during summer 60−70% of the coastal stations are showing an increasing trend in critical extreme maximum day temperature and increased in night temperature.

The aim of present research is to analyze the trend and variability of climatic parameters data over a period of 33 years (1981−2013). This is an effort to detect the possible seasonal trend and variability of maximum, minimum temperature, rainfall, rainy days, relative humidity and wind speed.

II. MATERIALS AND METHODS

Meteorological data were collected at Agro-metrological observatory, CRC, G.B.P.U.A. &T., Pantnagar-263145,Uttarakhand which is situated in the southern part of the outer foothill of the Himalaya and located $28^o26'$ N latitude and between $78^o53'$ and $80^o0'$ E longitude. Its altitude above the mean sea level is 243.8 meters. The tarai is a belt of marshy grassland, savannas, and forests. Climate of tarai region is characterized by important annual variations in temperature as well as rainfall. Winter temperature is too low while, summer temperature is very high. The temperature is lowest (2−4^{o}C) in December-January and highest (40−42^{o}C) in May-June. The variability in rainfall within different seasons is greater with high relative humidity throughout the year.

In the present research winter, Pre-monsoon, monsoon and Post-monsoon seasonal means of weather parameters viz., maximum, minimum temperature, rainfall, rainy days, relative humidity and wind speed data were collected over a period of 33 years (1981−2013) of tarai region of Uttarakhand and statistical analysis was carried out, application of parametric statistics test, regression analysis, coefficient of determination R^2, Q. Q. Plot Normal trend test for monsoon season rainfall, trend as general movement of weather parameters over an extended period of time, weather parameters under study were not normally distributed we have calculated median, standard error of median, confidence interval for the above weather parameters. If the observations are not normally distributed and some data are summarized, then the median $\tilde{x}$ with its standard error $s_{\tilde{x}}$ is stated: $\tilde{x} \pm s_{\tilde{x}}$. Arrange the observations in ascending order, the standard error of median is estimated by $[1/3.4641]\left\{\left[\text{the value of the } \left(n/2+\sqrt{3n/2}\right)^{th} \text{ observation}\right] - \left[\text{the value of the } \left(n/2-\sqrt{3n/2}\right)^{th} \text{ observation}\right]\right\}$, with both values round up to the next whole number. If the observations are random numbers, it is better to generalize in giving the confidence interval for median of the population.

Confidence interval (CI) for the median ($\tilde{\mu}$): 95% CI and 99% CI for $\tilde{\mu}$: $n \leq 100$ by means of tables MacKinnon, (1964) above 5% and 1% columns, according to, $\textbf{LB} \leq \tilde{\mu} \leq 1 + \textbf{RB}$,when populations are not normally distributed. If the 'n' observations, ordered by magnitude, are written as: $x_{(1)}, x_{(2)}, x_{(3)}, \cdots, x_{(n)}$,then the distribution free confidence interval for median ,the 95%,and the 99% CI for $\tilde{\mu}$ are given by $x_{(h)} \leq \tilde{\mu} \leq x_{(n-h+1)}$. For n > 50 and the confidence probabilities 90%, 95%, and 99% can be approximated by $h = \left(n - z\sqrt{n} - 1\right)/2$, ,with z = 1.64,1.96 and 2.58 respectively.

III. RESULTS AND DISCUSSIONS

Table-1 shows seasonal variation, in time series over the period of 33 years (1981-2013) of maximum mean temperature highest in Pre-monsoon season is 33.5668°C ,lowest temperature in Winter season is 21.7768°C, an average temperature is 29.3432°C and observed an average increase rate is 0.1934°C. Coefficient of variation, maximum is 12.67% in Pre-monsoon season and coefficient of variation minimum is 6.69% in the monsoon season. In all seasons the maximum temperature data did not follow normal distribution because the skewness, $\gamma_1 \neq 0$ and the kurtosis i.e. $\beta_2 \neq 3$, then median $\tilde{x}$ with its standard error $s_{\tilde{x}}$ and confidence interval (CI) for the median is calculated.

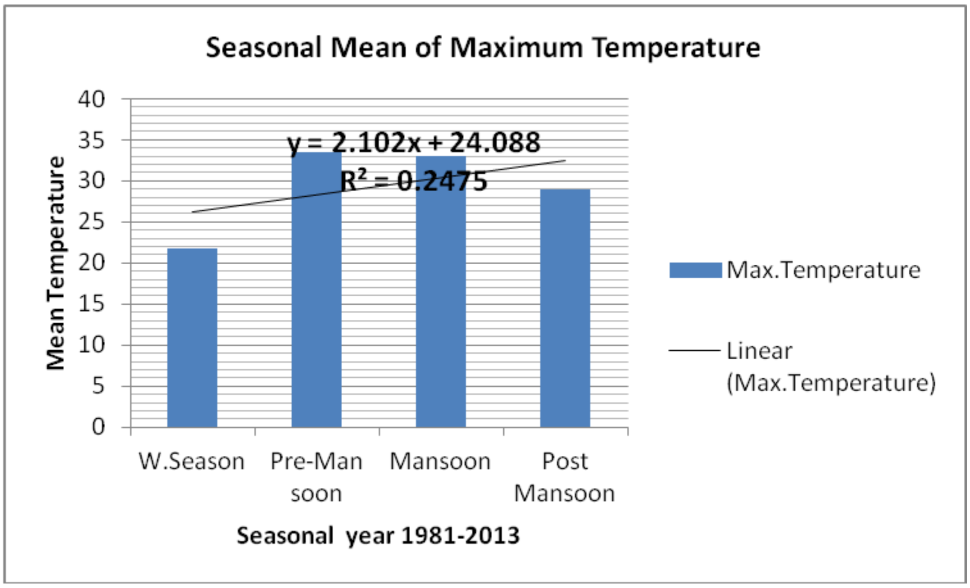

Figure-1Seasonal mean of maximum Temperature

Figure-1 shows regression analysis indicates a trend line for sesonal mean of maximum temperature agaist time is increasing $\beta = 2.102$, indicates a positive linear relationship between seasonal maximum mean temperature and time, the coefficient of determination $R^2 = 0.2475$, indicating only 24.75% variation in maximum temperature seasonal time series over the period of 33 years (1981-2013).

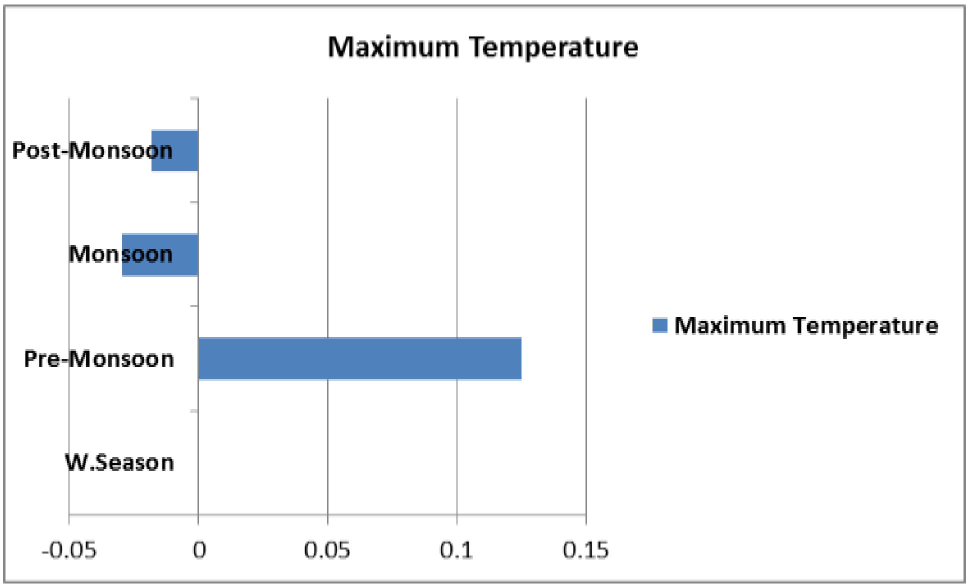

Figure-1(a)Trend of Individual Seasonal mean of maximum Temperature

The maximum temperature indicates an increasing trend in Pre-monsson season and decreasing trend in the monsoon , Post monsoon seasons and stable in winter season.

Table-1 shows seasonal variation, in time series over the period of 33 years (1981-2013) of minimum mean temperature highest in monsoon season is 24.6846°C ,lowest temperature in winter season is 7.5227°C, an average temperature is 15.9364°C and observed an average increase rate is 0.02177°C. Coefficient of variation, maximum is 24.87% in Pre-monsoon season and coefficient of variation, minimum is 4.0532% in monsoon season. In all seasons the maximum temperature data did not follow normal distribution because the skewness, $\gamma_1 \neq 0$ and the kurtosis i.e. $\beta_2 \neq 3$, then median $\tilde{x}$ with its standard error $s_{\tilde{x}}$ and confidence interval (CI) for the median is calculated.

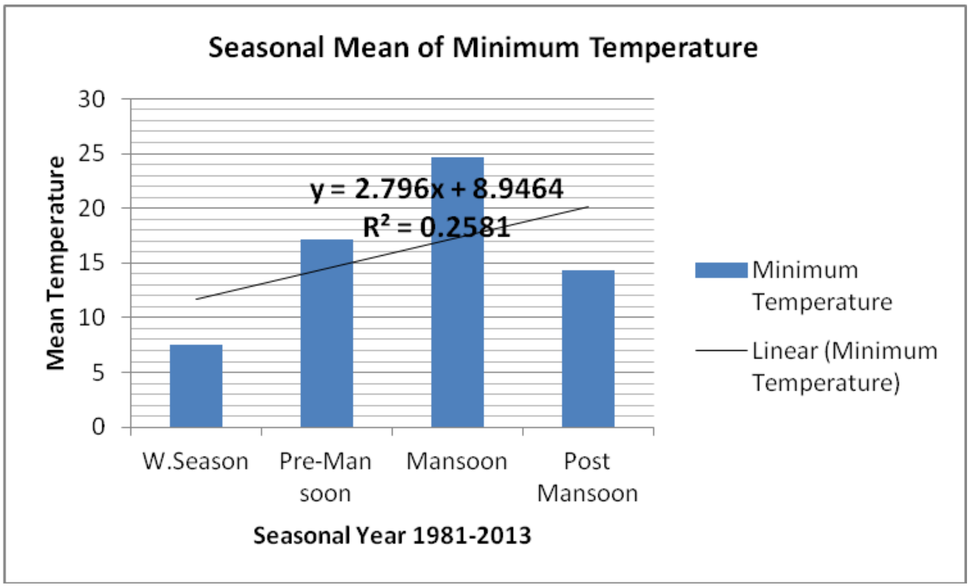

Figure-2 Seeasonal mean of minimum Temperature

Figure-2 shows regression analysis indicates a trend line for sesonal mean of minimum temperature agaist time is increasing β = 2.796, indicates a positive linear relationship between seasonal minimum mean temperature and time, the coefficient of determination R^2 = 0.2581, indicating only 25.81% variation in minimum temperature seasonal time series over the period of 33 years (1981-2013).

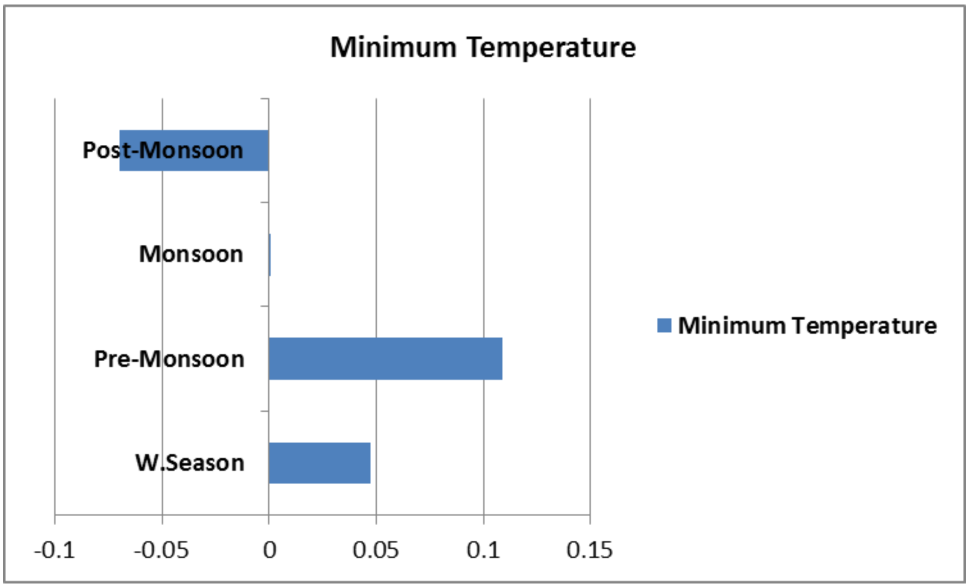

Figure-2(a)Trend of Individual Seasonal mean of minimum Temperature

The minimum temperature indicates an increasing trend in winter season,Pre-monsoon season, monsoon season and decreasing trend in Post-monsoon season.

Table-1 shows seasonal variation, in time series over the period of 33 years (1981-2013) of mean relative humidity 712 highest in winter season is 91.6768%, lowest in Pre-monsoon season is 72.1828%, an average relative humidity 712 is 83.2483% and observed an average decrease rate is − 0.00756%. Coefficient of variation, maximum is 15.26% in Pre-monsoon season and coefficient of variation minimum is 3.22% in the winter season. In all seasons the relative humidity data 712 did not follow normal distribution because the skewness, $\gamma_1 \neq 0$ and the kurtosis i.e. $\beta_2 \neq 3$, then median $\tilde{x}$ with its standard error $s_{\tilde{x}}$ and confidence interval (CI) for the median is calculated.

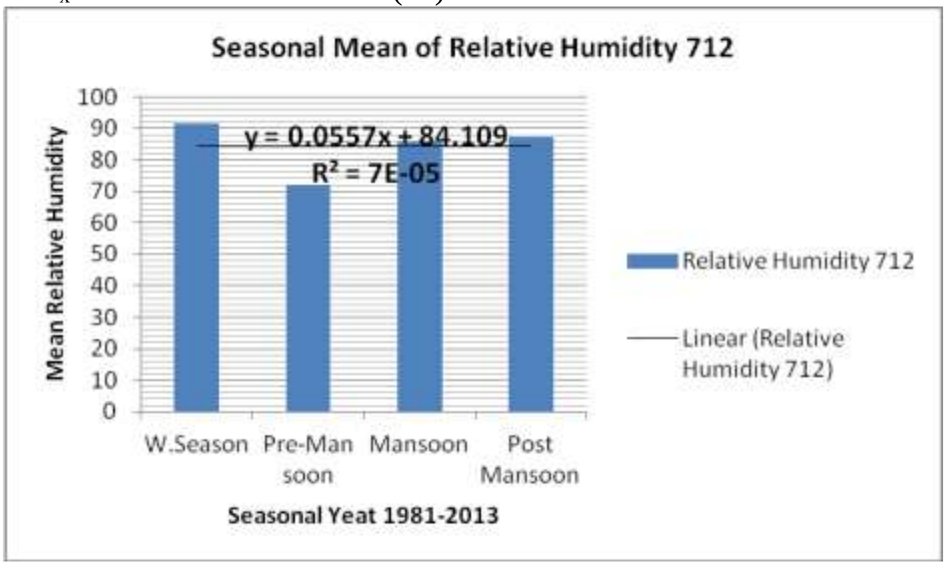

Figure-3Seasonal mean of relative humidity 712

Figure-3 shows regression analysis indicates a trend line for sesonal mean of realtive humidity 712 agaist time is increasing β = 0.0557, indicates a positive linear relationship between seasonal relative humidity 712 and time, the coefficient of determination $R^2 = 0$, indicating no variation in realtive humidity seasonal time series over the period of 33 years (1981-2013).

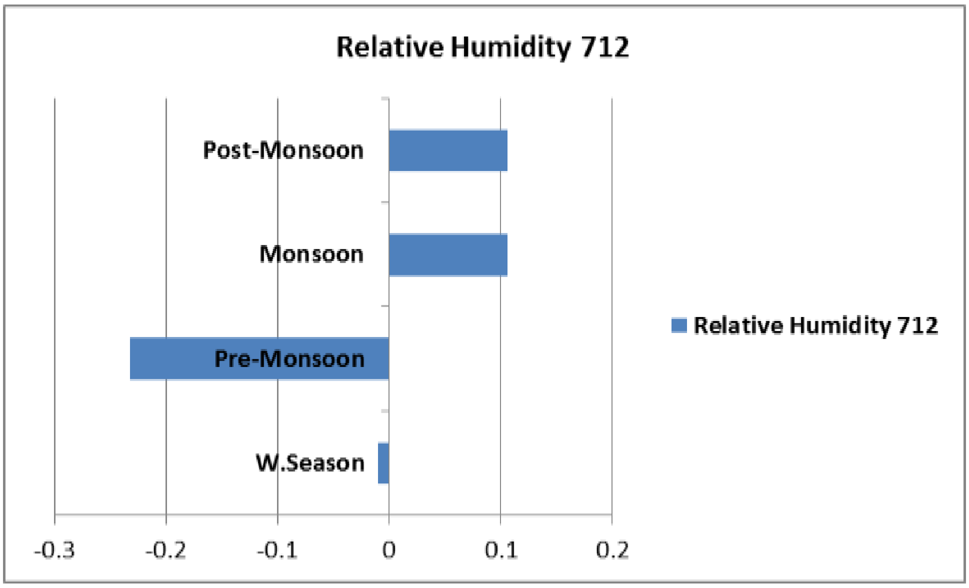

Figure-3(a) Trend of Individual Season mean of relative humidity 712

The relative humidity 712 indicates an increasing trend in monsson season,Post-monsoon season and decreasing trend in the winter season , Pre-monsoon season.

Table-1 shows seasonal variation, in time series over the period of 33 years (1981-2013) of mean relative humidity1412 highest in monsoon season is 64.8462 %, lowest in Pre-monsoon season is 32.2111%, an average relative humidity 1412 is 48.5421% and observed an average increase rate is 0.06375 %. Coefficient of variation, maximum is 29.14% in winter season and coefficient of variation minimum is 16.46% in the Post-monsoon season. In all seasons the relative humidity data 1412 did not follow normal distribution because the skewness, $\gamma_1 \neq 0$ and the kurtosis i.e. $\beta_2 \neq 3$, then median $\tilde{x}$ with its standard error $s_{\tilde{x}}$ and confidence interval (CI) for the median is calculated.

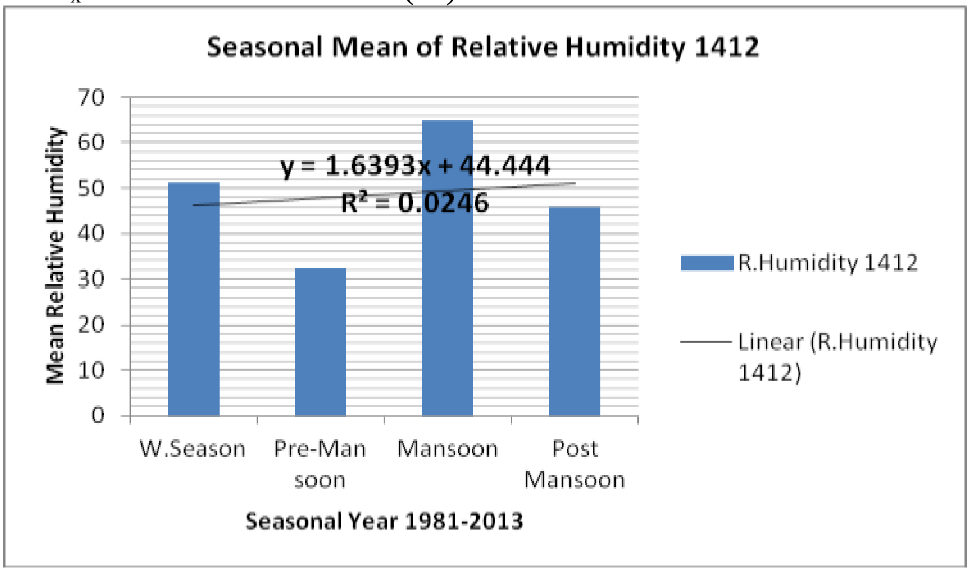

Figure-4 Seasonal mean of relative humidity 1412

Figure-4 shows regression analysis indicates a trend line for sesonal mean of realtive humidity 1412 against time is increasing β = 1.6393, indicates a positive linear relationship between seasonal relative humidity 1412 and time, the coefficient of determination R^2 = 0.0246, indicating 2.46% variation in realtive humidity seasonal time series over the period of 33 years (1981-2013).

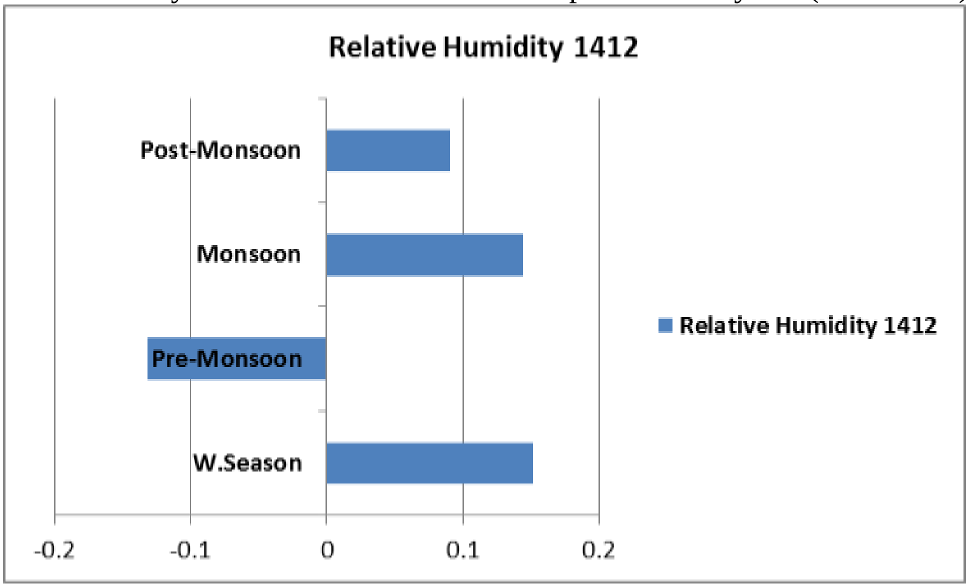

Figure-4(a) Trend of Individual Seasonal mean of relative humidity 1412

The relative humidity 1412 indicates an increasing trend in winter season, monsoon season ,Post-monsoon season and decreasing trend in Pre-monsoon season.

Table-1 shows seasonal variation, in time series over the period of 33 years (1981-2013) of mean rainfall highest in monsoon season is 348.0392 mm, lowest in Post-monsoon season is 24.4515 mm, an average rainfall is 107.6368mm and observed an average increase rate is 0.0319 mm. Coefficient of variation, maximum is 267.04% in Post-monsoon season and coefficient of variation minimum is 61.6882 % in the monsoon season. In all seasons the rainfall data did not follow normal distribution because the skewness, $\gamma_1 \neq 0$ and the kurtosis i.e. $\beta_2 \neq 3$, then median $\tilde{x}$ with its standard error $s_{\tilde{x}}$ and confidence interval (CI) for the median is calculated.

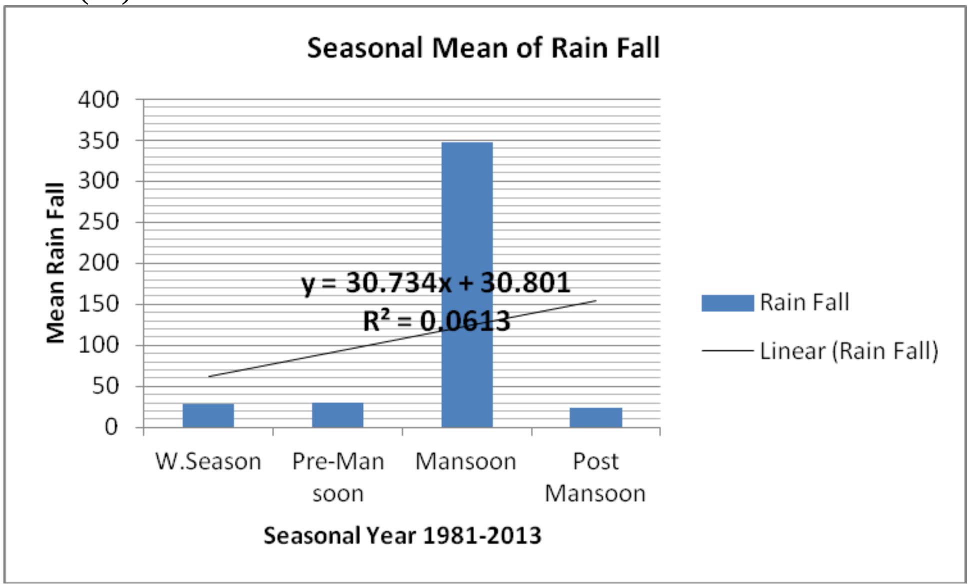

Figure-5 Seasonal Mean of Rainfall

Figure-5 shows regression analysis indicates a trend line for sesonal mean of rainfall agaist time is increasing β = 30.734, indicates a positive linear relationship between seasonal rainfall and time, the coefficient of determination $R^2 = 0.0613$, indicating 6.13% variation in rainfall seasonal time series over the period of 33 years (1981-2013).

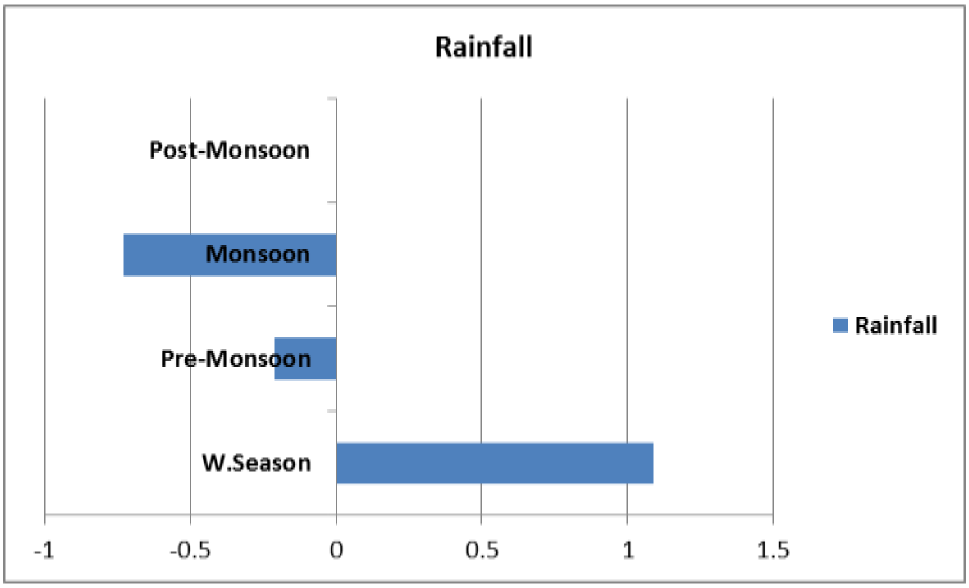

Figure-5(a) Trend of Individual Seasonal mean of rainfall

The rainfall indicates an increasing trend in winterseason, and decreasing trend in Pre-monsoon season, monsoon season and stable in the Post-monsson season.

Figure-5(b) Shows Quantile-Quantile plot monsoon season rainfall trend test and observed skewed to right,for monsoon season rainfall time series over the period of 33 years (1981-2013).

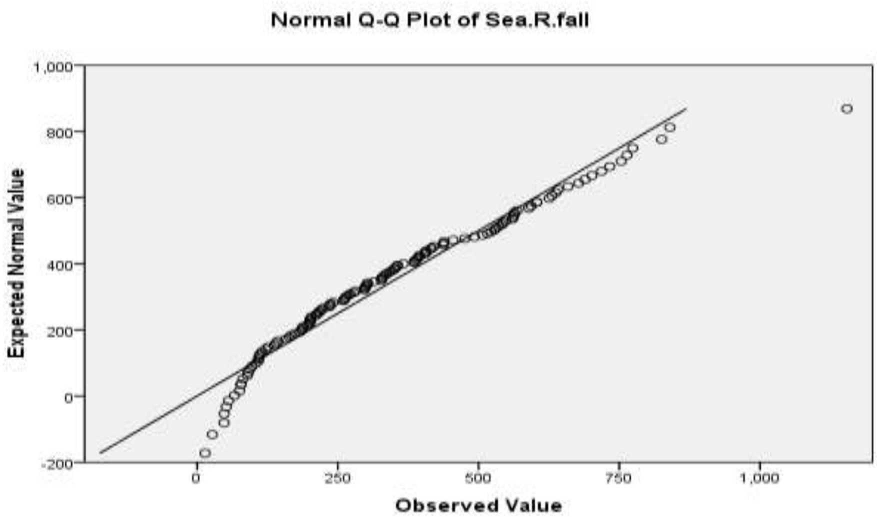

Figure-5(b):**Quantile-Quantile plot for normal trend test of monsoon season rainfall for the years (1981-2013).**

Table-1 shows seasonal variation, in time series over the period of 33 years (1981-2013) of mean rainy days highest in monsoon season is 14.0538 days, lowest in Post-monsoon season is 1.7324 days, an average rainy days is 5.3493days and observed an average increase rate is 0.03156 days. Coefficient of variation, maximum is 136.12% in Post-monsoon season and coefficient of variation minimum is 39.06 % in the monsoon season. In all seasons the rainy days data did not follow normal distribution because the skewness, $\gamma_1 \neq 0$ and the kurtosis i.e. $\beta_2 \neq 3$, then median $\tilde{x}$ with its standard error $s_{\tilde{x}}$ and confidence interval (CI) for the median is calculated.

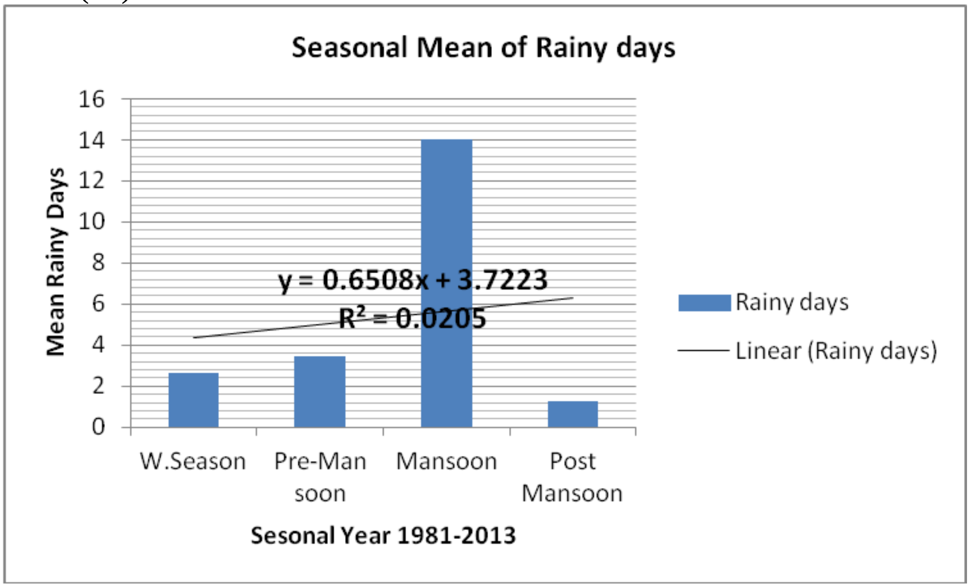

Figure-6 Seasonal mean of rainy days

Figure-6 shows regression analysis indicates a trend line for sesonal mean of rainy days agaist time is increasing $\beta = 0.6508$, indicates a positive linear relationship between seasonal rainy days and time, the coefficient of determination $R^2 = 0.0205$, indicating 2.05% variation in rainfall seasonal time series over the period of 33 years (1981-2013).

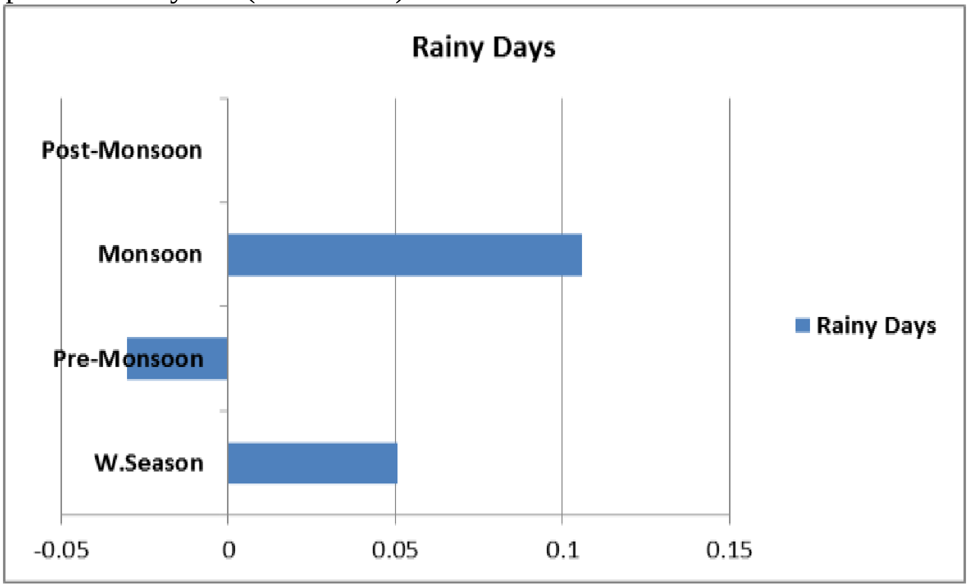

Figure-6(a) Trend of Individual Seasonal mean of rainy days

The rainy days indicates an increasing trend in winter season, monsoon season and decreasing trend in Pre-monsoon season , and stable in the Post-monsson season.

Table-1 shows seasonal variation, in time series over the period of 33 years (1981-2013) of mean wind speed highest in Pre-Monson season is 6.5818Km/hour, lowest in Post-monsoon season is 2.5333Km/hour, an average wind speed is 4.7183Km/hour and observed an average decrease rate is − 0.0054 km/hour. Coefficient of variation, maximum is 38.166% in winter season and coefficient of variation minimum is 29.40 % in the Post-monsoon season. In all seasons the rainy days data did not follow normal distribution because the skewness, $\gamma_1 \neq 0$ and the kurtosis i.e. $\beta_2 \neq 3$, then median $\tilde{x}$ with its standard error $s_{\tilde{x}}$ and confidence interval (CI) for the median is calculated.

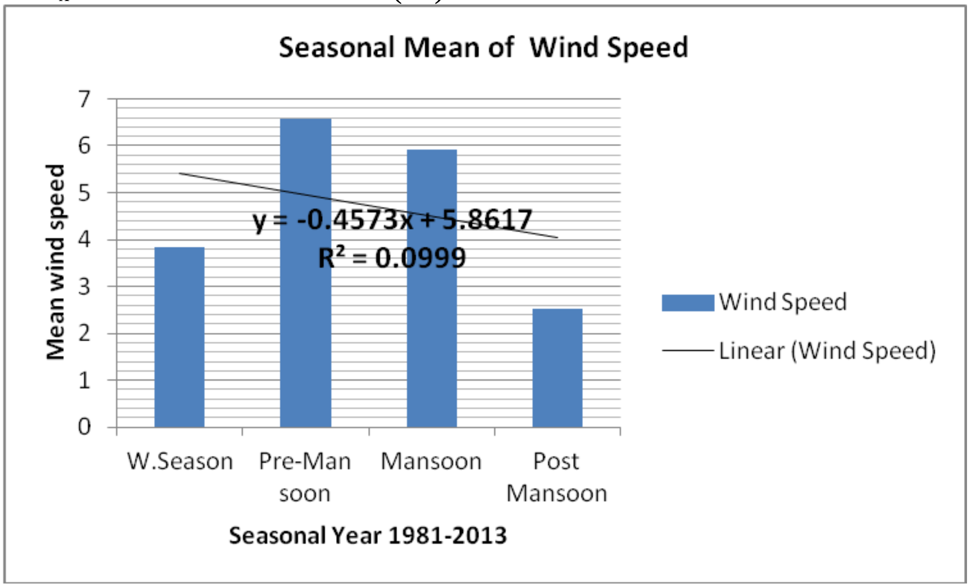

Figure-7 Seasonal mean of Wind Speed

Figure-7shows regression analysis indicates a trend line for sesonal mean of wind speed agaist time is decreasing $\beta = -0.4573$, indicates a negative linear relationship between seasonal wind speed and time, the coefficient of determination $R^2 = 0.0999$, indicating 9.99% variation in wind speed seasonal time series over the period of 33 years (1981-2013).

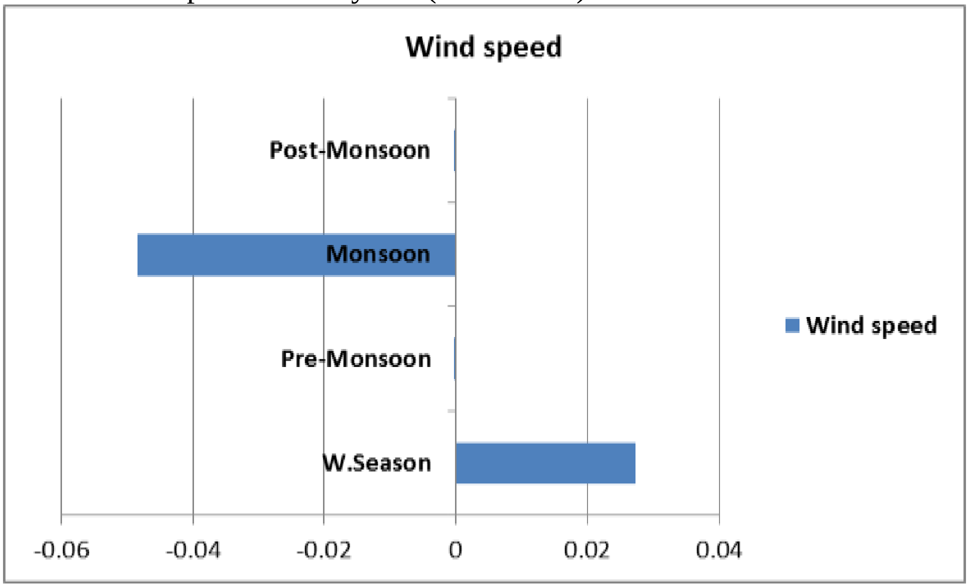

Figure-7(a) Trend of Individual Seasonal mean of Wind speed

The wind speed indicates an increasing trend in winter season, and decreasing trend in Pre-monsoon season , monsoon season ,Post-monsson season.

Table-2 shows Seasonal correlation between rainfall and rainy days ,Pearson's correlation coefficient was applied to measure the degree of relationship between seasonal mean of rainfall and rainy days at α =.01, level of significance (two tailed test) and observed highly significant positive correlation in winter season 'r' is 0.666and p-value is <.0001, Pre-monsoon season 'r' is 0.668 and p-value is <.0001, monsoon season 'r' is 0.678 and p-value is <.0001.Post-monsoon season 'r' is 0.789 and p-value is <.0001

Table 2:Seasonal Correlation between Rainfall and Rainy days						
Seasons	R	r^2	t-value	p-value	α	Result
Winter Season	0.666	0.443556	8.7938	<.0001	.01	Significant
Pre-Monsoon	0.668	0.446224	11.879	<.0001	.01	Significant
Monsoon	0.678	0.459684	10.5160	<.0001	.01	Significant
Post Monsoon	0.789	0.622521	10.2734	<.0001	.01	Significant

IV. CONCLUSIONS

The maximum, minimum temperature, relative humidity 712, and 1412, rain fall, rainy days and wind speed, climatic parameters seasonally time series over the period of 33 years (1981-2013),were studied and observed an increasing and decreasing trend, the statistical analysis indicates a mean increase in maximum temperature is 0.1934°C, minimum temperature is 0.0217°C,the mean increase in relative humidity1412 is 0.0637%, mean decrease in relative humidity712 is − 0.0075% and rain fall mean increase is 0.0319 mm with slightly mean increase in rainy days is 0.0315days,wind speed indicates slightly mean decrease is – 0.0054 km/hour. Quantile-Quantile trend test of monsoon seasonal rainfall, observed skewed to right.Pearson's correlation coefficient was applied to measure the degree of relation ship between seasonal mean rainy days and seasonal mean rainfall and observed highly significant correlation between seasonal mean rainy days and seasonal mean rainfall. Seasonal climatic parameters, maximum temperature, minimum temperature, relative humidity712and1412, rainfall, rainy days and wind speed, observed an increasing and decreasing trend. Fluctuations are observed in weather parameters of tarai region of Uttarakhand.

Table 1: Seasonal Statistical analysis of weather parameters over a period of 33 years (1981-2013)

Winter Season Statistics 1981-2013											
Weather parameters	Mean $\bar{X}$	σ	C.V. %	Median $\tilde{X}$	Standard error $\tilde{X} \pm S_{\tilde{X}}$	95% CI for Median $LB \le \tilde{\mu} \le 1+RB$	Skew.	Kurt.	Range	Minimum	Maximum
Max Temp.	21.7768	2.11355	9.7055	22.1000	22.10 ± 1	21.6 ≤ 22.10 ≤ 22.6	-0.766	0.912	12.20	14.50	26.70
Min Temp.	7.5227	1.39625	18.56	3.90196	3.90 ± 0.7	7.1 ≤ 3.90 ≤7.8	0.25	0.044	7.20	4.30	11.50
R.H.712	91.6768	2.95486	3.22	92.000	92.00 ± 0	91 ≤ 92.00 ≤92.0	-3.56	23.701	25.00	71.00	96.00
R.H.1412	51.2626	8.15861	29.14	51.0000	51.00 ± 4	49 ≤ 51.00 ≤ 53.0	0.454	0.287	42.00	34.00	76.00
Rain Fall	27.9970	36.0963	128.92	14.6000	14.60 ± 13	9.2 ≤ 14.60 ≤ 20.6	1.821	3.149	160.20	0.00	160.20
Rainy Days	2.6465	2.35742	89.756	2.000	2.00 ± 1	2 ≤ 2.00 ≤ 3.0	1.083	1.555	12.00	0.00	12.00
W. Speed	3.8374	1.46459	38.166	3.8000	3.80 ± 0.3	3.6 ≤ 3.80 ≤ 4.0	1.143	4.370	9.80	1.10	10.90
Pre-Monsoon Season Statistics 1981-2013											

Max Temp.	33.5668	4.25543	12.67	35.1000	35.10 ± 1.1	25 ≤ 35.10 ≤ 35.5	-0.564	-0.686	18.70	21.30	40.00
Min Temp.	17.1929	4.27704	24.87	17.1000	17.10 ± 1.4	17.1 ≤ 17.10 ≤ 18.1	0.145	-1.243	15.10	10.70	25.80
R.H.712	72.1828	11.0159	15.26	70.0000	70.00 ± 5	70 ≤ 70.0 ≤ 72.0	0.229	-1.174	42.00	49.00	91.00
R.H.1412	32.2111	9.21168	28.59	33.0000	33.00 ± 6	32 ≤ 33.0 ≤ 35.0	-0.132	0.257	51.00	2.00	53.00
Rain Fall	30.0596	43.4629	144.58	16.8000	16.80 ± 14.6	16.2 ≤ 16.80 ≤ 25.0	3.871	22.013	325.8	.00	3325.80
Rainy Days	3.4242	2.62286	76.59	3.0000	3.00 ± 1	3.0 ≤ 3.00 ≤ 4.0	0.788	0.245	11.00	.00	11.00
W. Speed	6.5818	2.37002	36.00	6.7000	6.70 ± 0.8	6.6 ≤ 6.70 ≤ 7.0	0.386	1.143	14.20	.00	14.20
Monsoon Season Statistics1981-2013											
Max Temp.	33.0854	2.21643	6.69	32.4000	32.40 ± 0.6	32.1 ≤ 32.40 ≤ 32.5	1.375	1.233	10.20	29.90	40.10
Min Temp.	24.6846	1.02499	4.15	24.9500	24.95 ± 0.7	24.7 ≤ 24.95 ≤ 25.1	-0.493	0.283	6.10	21.60	27.70
R.H.712	85.8154	8.12383	9.46	89.000	89.00 ± 2.0	88 ≤ 89.00 ≤ 89.0	-1.444	1.317	34.00	62.00	96.00
R.H.1412	64.8462	11.9906	18.49	68.000	68.00 ± 5.0	67 ≤ 68.00 ≤ 70.0	-1.364	1.676	66.00	19.00	85.00
Rain Fall	348.039	214.699	61.68	320.800	320.80 ±129.6	262.2≤320.80≤350.2	0.747	0.447	1140.4	14.20	1154.60
Rainy Days	14.0538	5.49039	39.06	15.000	15.00 ± 3.0	13.0 ≤ 15.00 ≤ 15.0	-0.187	-0.822	23.00	2.00	25.00
W. Speed	5.9208	2.17208	36.685	5.8000	5.800 ± 1.1	5.1 ≤ 5.80 ≤ 6.1	0.351	0.059	12.10	.00	12.10
Post-Monsoon Season Statistics 1981-2013											
Max Temp.	28.9439	2.02326	6.99	28.2500	28.25 ± 2.50	27.7 ≤ 28.25 ≤ 30.3	0.068	-1.310	7.90	24.70	32.60
Min Temp.	14.3455	3.24977	22.63	14.4500	14.45 ± 4.30	11.8 ≤ 14.45 ≤ 16.4	0.042	-1.651	10.30	9.50	19.80
R.H.712	87.3182	3.35196	3.83	88.000	88.00 ± 1.0	87 ≤ 88.00 ≤ 88.0	-0.427	1.123	19.00	77.00	96.00
R.H.1412	45.8485	7.54727	16.46	45.000	45.00 ± 4.0	43 ≤ 45.00 ≤ 48.0	0.517	-0.025	33.00	33.00	66.00
Rain Fall	24.4515	65.2958	267.04	0.3000	0.300 ± 2.4	0≤ 0.500 ≤ 6.0	3.751	14.421	354.2	.00	354.20
Rainy Days	1.2727	1.73245	136.12	0.5000	0.500 ± 1.0	0 ≤ 2.45 ≤ 1.0	1.632	2.874	8.00	.00	8.00
W. Speed	2.5333	0.74490	29.40	2.4500	2.45 ± 0.4	2.3 ≤ 2.45 ≤ 2.7	0.263	0.096	3.80	0.70	4.50

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