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Perturbations of climatic elements of Jorhat, Assam

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ABSTRACT

Major climatic elements of Jorhat, Assam, for the period 1981-90 have been compared with those of the normal values. Significant increase of average monthly maximum and minimum temperature was observed in the months of October, November and December whereas the months of March and April were cooler than normal. Continentality factor for Jorhat had increased by 8 percent. Total monthly rainfall during May to August showed significant decrease. There was significant decrease of morning relative humidity but increasing tendency of evening relative humidity was seen. Significant decrease of bright sunshine hours occurred during September.

Key words: Perturbations, Climatic elements, Continentality factor.

In recent times, the phenomenon of global warming has been widely discussed. There have been reports of climatic fluctuations in some parts of the globe. However, global warming does not exclude the possibilities of local variations of climatic elements in opposite directions. The present study is an assessment of the climatic perturbations at Jorhat.

MATERIALS AND METHODS

Monthly averages of maximum and minimum temperatures, morning and evening relative humidity, total rainfall, total evaporation and sunshine hours at Jorhat for the period 1981-90 have been collected from the records of the Agrometeorological Observatory of Assam Agricultural University, Jorhat (26°47′ N, 94°12′ E, 87m AMSL). These were compared with the corresponding normals (Anonymous, 1997). The data were statistically analysed (t - test) to observe any significant difference between the two sets of values.

The continentality factor K was calculated using Conrad's formula (Conrad and Pollak, 1950).

$$K = [1.7\ A / \sin(\theta + 10) - 14]$$

Where, A is difference between the mean temperature of the hottest and the coldest month and θ is the latitude of the place (26°47′ N for Jorhat). If K_D and K_N are the decadal (1981-90) and normal values of K for Jorhat, then percent increase of K_D is obtained as $(K_D - K_N) / K_N$

RESULTS AND DISCUSSION

Temperature and continentality factor

The monthly average maximum temperature was higher than the normal values during the months from October to February, May, June and August (Table 1). Only four months viz., March, April, July and September showed negative maximum temperature deviation from normal during the decade. Deviations were statistically significant during March, June, August, November and

December.

In case of minimum temperature positive deviations from normal were observed only during October, November and December and in rest of the months the deviations were negative. The deviations were well beyond the SEM of normals in all the months from January to July. On the other hand, the deviations were within or very close to the SEM of normals from August to December. Deviations were statistically significant only in April. As a result during the decade monthly temperature range increased in nine out of twelve months. March, September and October were the exceptions. Positive deviations of monthly temperature range were highly significant in January, February, May, June, November and December.

Monthly average temperature at Jorhat during the decade showed significant positive deviations from the normals during five months viz., June, August, October, November and December. The rest of the months showed negative temperature deviation from the normal with significant values in the months of March and April. It is clear that the post monsoon months (October to December) were warmer and pre monsoon months (March to May) were cooler during the decade than the normal. Between May and September monthly average temperature showed oscillatory nature. January and February practically showed no temperature variation .

Cooling or warming of a month during the decade cannot be attributed soley to change in rainfall amount in those months, because as seen from Table 2, monthly rainfall at Jorhat had sub-normal values in March but it had become cooler. Same reason is applicable to the months of May and July. Similarly during October, both rainfall and average temperature were higher than normal.

The significant increase in monthly temperature range was an indicative of higher continentality factor. The continentality factor for Jorhat as calculated from Conrad equation shows an 8 per cent increase during the decade over its normal value of 21.0.

Rainfall

The average annual rainfall at Jorhat during the decade was 13.12 per cent lower than the normal values. Except in January, April and October, in all the other months the total rainfall was lower than their normal values. The decrease was highly significant in March, July and August and significant in May. On the other hand, the rainfall in April and October increased significantly. Though there was positive deviation of January rainfall it has little significance because of the higher uncertainity of the event in this month.

It seems as if a quantum of rainfall due in March had been delivered in April during the decade indicating a shift in passage of weather systems. Decrease of rainfall in February and March delays the recharging of the aquifer. Similarly, in the month of May a decrease in the quantum of rainfall coupled with increase in maximum temperature (Table 1) and BSSH (Fig. 3) is detrimental to rainfed sali rice crop because it is the time of raising seedlings in nursery beds. Decrease of rainfall in August sometimes leads to drought conditions for newly established sali rice seedlings. Significant decrease of monsoon rainfall (June to September) in the district is difficult to explain from this analysis

Table 1: Monthly temperature variations at Jorhat.

Temperature (°C)												
Month	Maximum			Minimum			Average			Range		
	D	N	D - N	D	N	D - N	D	N	D - N	D	N	D - N
Jan	22.8	22.5	+0.3	9.4	9.8 (±0.26)	-0.4	16.1	16.2	-0.1	13.4	12.7	+0.7 **
Feb	23.8	23.5	+0.3	11.8	12.3 (±0.22)	-0.5	17.1	17.9	0.0	11.9	11.2	+0.7 **
Mar	26.8	27.8	-1.0 *	15.3	15.8 (±0.30)	-0.5	21.1	21.8	-0.7 *	11.6	12.0	-0.4
Apr	27.4	28.9	-1.5	17.9	19.5 (±0.16)	-1.6 *	22.7	24.2	-1.5 **	10.1	9.4	+0.7
May	30.1	29.7	+0.4	21.5	22.3 (±0.30)	-0.8	25.8	26.0	-0.2	8.6	7.4	+1.2 **
Jun	32.3	31.4	+0.9 *	24.2	24.5 (±0.15)	-0.3	28.3	29.0	+0.3 *	8.1	6.9	+1.2 **
Jul	31.8	32.0	-0.2	24.7	25.0 (±0.12)	-0.3	28.3	28.5	-0.2	7.2	7.0	+0.2
Aug	32.9	31.9	+1.0 *	25.0	25.0 (±0.14)	0.0	29.0	28.5	+0.5 *	7.9	6.9	+1.0 **
Sept	31.1	31.4	-0.3	24.1	24.3 (±0.19)	-0.2	27.7	27.9	-0.2	7.0	7.1	-0.1
Oct	30.0	29.4	+0.6	21.6	21.4 (±0.27)	+0.2	25.8	25.4	+0.4 *	8.0	8.0	0.0
Nov	27.4	26.6	+0.8	15.4	15.1 (±0.22)	+0.3	21.4	20.9	+0.5 *	12.1	11.5	+0.6 *
Dec	23.7	22.9	+0.8	10.7	10.6 (±0.24)	+0.1	17.2	16.8	+0.4 *	13.1	12.3	+0.8 *

D = For the decade 1981-90, N = Normal values, * = Significant at 5 percent level

** = Significant at 10 percent level

Figures in parenthesis indicate the standard error difference

alone. Significant increase in October rainfall will negatively influence rice production since this period corresponds to flowering stage of the crop.

Relative humidity (RH)

The average monthly morning RH was lower than the normal values in all the months during the decade (Fig. 1). Decrease is highly significant in all the months except in February and April. The evening RH , on the other hand , had increased significantly in the months of January to April, July, September , October and December. During the other months evening relative humidity was lower than the normal values but the decrease was not significant. Decrease of morning RH has reduced the number of foggy days in winter. Winter mornings had, thus become warmer and drier in the decade.

Evaporation

The average monthly evaporation showed significant increase during the months of October to January (Fig. 2). This corresponds to the positive increase in temperature (Table 1). However, monthly evaporation decreased during the months of

Table 2 : Average monthly total rainfall variation at Jorhat.

Months	Normal rainfall (mm)	Rainfall (mm) during the decade 1981-90	Deviation from the normal (%)
Jan	17.8	19.7	+ 10.67
Feb	37.5	32.1	- 14.40
Mar	95.9	69.1	- 27.95 **
Apr	195.3	223.1	+ 14.23
May	258.3	214.9	- 16.80 *
Jun	321.9	287.1	- 10.81
Jul	457.7	396.4	- 13.39 **
Aug	388.0	275.0	- 29.12 **
Sept	262.4	262.5	+ 0.04
Oct	135.7	102.1	+24.76 *
Nov	16.6	15.9	- 4.22
Dec	11.4	11.4	0.00
Annual	2197.7	1909.3	- 13.12

* = Significant at 10 per cent level ** = Significant at 5 per cent level

April, July and September and corresponds to significant increase in afternoon relative humidity.

Bright sunshine hours (BSSH)

The annual total BSSH of Jorhat during the decade (2142.7 hrs) has increased slightly from its normal annual value of 2129.2 hrs. But the distribution pattern had changed during March to June, September, November and December (Fig. 3) . Significant decrease of BSSH is observed in the months of April and September while there is significant increase during the month of November.

There has been significant perturbations in temperature and rainfall at Jorhat during the decade under consideration. Warming of the winter months and cooling of March - April is important for planning *rabi* crops. Decrease of rainfall in entire Assam in recent past has been reported (Nath and Bora, 1994; Govinda Rao, 1993). These observations do

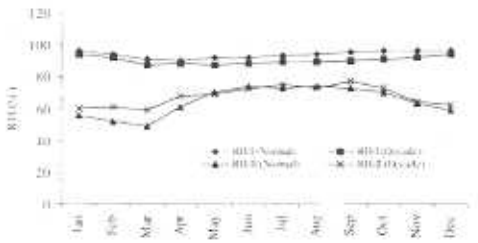

Fig.1 : Monthly relative humidity at Jorhat.

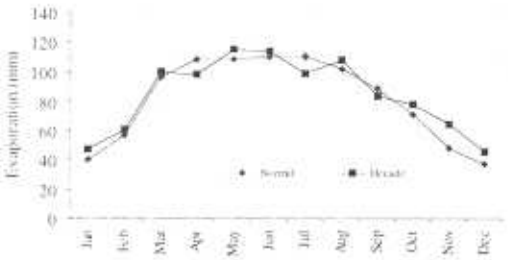

Fig.2 : Monthly evaporation at Jorhat.

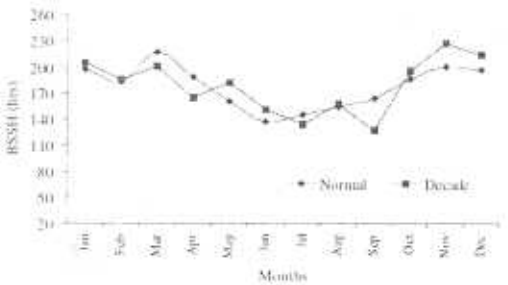

Fig.3 : Monthly bright sunshine hours at Jorhat.

not presently substantiate that warming is occurring in this part because global warming should accompany with increasing rainfall. Taking the annual values it is seen that the temperature of this region showed a net cooling during the decade. The climatic perturbations may be a result of many interacting factors such as urbanisation , increase in consumption of fossil fuels, rapid growth of population and deforestation. Sufficient data are not available to conclusively prove whether the perturbation is a transient phenomenon or it will persist

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