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Variability of climatic elements at Jorhat

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ABSTRACT

Major climatic elements of Jorhat, Assam for the period 1991-2000 have been compared with those of normal values. The total rainfall was lower than their normal values in all months except in February, September and October with significant decrease in the month of April. Pre-monsoon and monsoon rainfall decreased by 18.8 and 3.3 per cent, respectively. Monthly minimum temperature increased in all months with significant increase during June to September and in November. Monthly maximum temperature increased during April, July and from September to December but decreased during the remaining six months. The monthly temperature range was reduced. Seasonal minimum and seasonal average temperature also increased but seasonal maximum temperature slightly decreased except during post-monsoon season. Morning vapour pressure increased from May to September and decreased during the other months. Evening vapour pressure increased throughout the year. The increase in vapour content indicates intensification of Green House effect. Monthly evaporation also decreased significantly throughout the year. Decrease in bright sunshine hours was observed during January to June and August to October.

Key words: Variability, climatic elements, Jorhat

In recent years, the phenomenon of global warming has widely been discussed and monitoring and analysis of climatic data have become more important. The Intergovernmental Panel on Climate Change (IPCC) has concluded that the global mean surface air temperature has increased by 0.3 to 0.6°C over the last 100 years and predicted a temperature increase of 0.2 to 0.5°C per decade. However, global warming does not exclude the possibilities of regional cooling too. The mean global surface temperature exhibited an increase over those during the last decades, particularly since the 1970's (Gadgil, 1996). The all-India mean annual surface temperature derived from 73 stations across India showed a significant warming by 0.4°C over the past 100 years, which is comparable to global mean trend of 0.3°C increase per 100 years (Hingane *et al*, 1985). Analysis of long-term rainfall data over different locations of India indicated that monsoon rainfall is trendless and mainly random in nature over a long period of time, particularly on all India scale (Rupa Kumar *et al*. 1992). The same authors showed a declining trend of rainfall in north-east India with large inter annual variability. Variations of rainfall and temperature on regional basis was studied by various workers (Sastri *et al*., 1996; Rajegowda *et al*., 2000; Hundal and Probhjot-Kaur, 2002; Ram Singh, 2003). Nath and Deka (2002) also reported decrease in average annual rainfall during the decade 1981-1990 than the normal values. The other climatic elements also showed significant perturbations.

MATERIALS AND METHODS

Monthly averages of maximum and minimum temperatures, morning and evening vapour pressure, total rainfall, total evaporation and sunshine hours at Jorhat for the period 1970-2000 have been collected from the records of the Agrometeorological Observatory of Assam Agricultural University, Jorhat (28°47′ N, 94°12′ E, 87 m AMSL). The data for the last decade (1991-2000) were compared with the normal values (1970-1990). The data were statistically analysed using Student's t - test (Panse and Sukhatme, 1985) to observe any significant difference between the two sets of values.

RESULTS AND DISCUSSION

Rainfall

The average annual rainfall at Jorhat during the decade 1991-2000 was 6.5 per cent lower than the normal value. Except in February, September and October, in all other months the total rainfall was lower than their normal values. The decrease was found to be significant in April only. Pre-monsoon and monsoon

Table 1: Variation of seasonal and annual rainfall at Jorhat

Seasons	Rainfall (mm) during 1970-1990			Rainfall (mm) during 1991-2000	Per cent departure from normal
	Rainfall amount	SEm ±	CV		
Pre-monsoon	545.7	61.3	51.5	443.0	-18.8
Monsoon	1247.9	42.9	15.7	1206.5	-3.3
Post-monsoon	149.3	17.9	54.9	151.5	+1.5
Winter	66.1	5.8	41.9	78.8	+19.2
Annual	2008.9	73.7	16.8	1879.9	-6.5

D = Decade (1991-2000) N = Normal (1970-1990)
* Significant at 5 % level ** Significant at 10 % level

rainfall had decreased by 18.8 and 3.3 per cent, respectively (Table 1). The post-monsoon and winter season showed positive departure from normal. However, the seasonal rainfall variations were non-significant. Decrease of rainfall in March and April delays the recharging of the aquifer. Decrease of rainfall in June, July and August (70.2 mm) sometimes leads to brief spells of drought for newly established *sali* rice seedlings.

Temperature

The monthly average maximum temperature was higher than the normal values during April, July and from September to December. The month January, February, March, May, June and August showed negative deviation from the normal during the decade. Maximum temperature during pre-monsoon, monsoon and winter seasons and the annual average maximum temperature revealed a deviation by –0.1°C while the post-monsoon season showed a deviation of +0.3°C during the decade. The deviations were, however, statistically not significant (Table 2).

In case of average minimum temperature, all the months and seasons showed positive deviations from the normal. The increase of minimum temperature was found to be significant during June to September and November. The increase of average minimum temperature was found to be significant during monsoon and post monsoon seasons. The mean annual minimum temperature increased significantly by +0.6°C during the decade (1991-2000).

Monthly average temperature indicated positive deviations from the normal during the months of February, April, May and from July to December. March and June practically showed no variation in average temperature. The increase was found to be significant in July, September and November. Seasonal average temperature also showed positive deviation from their normal values with significant deviation during monsoon and post-monsoon seasons (Table 2). The average annual temperature increased by 0.2°C during the decade under consideration, which was not significant.

The monthly temperature range decreased in all the months except in November which remained unchanged. The decrease was significant during June and August.

The significant warming during monsoon and post-monsoon coupled with decrease of rainfall during monsoon has considerable bearing on crop production. Decrease of monsoon rainfall increases uncertainty in its distribution and may lead to more frequent short dry spells. Such 'break' periods may negatively affect *sali* rice production and necessitates contingent plans for irrigation during *kharif* season under rainfed cropping system for maintaining desired level of standing water in the field.

Vapour pressure

The average monthly morning vapour pressure (VP) was slightly higher than the normal values from May to September with significant increase during May, June and July. During pre-monsoon and monsoon

Table 2: Variation of seasonal and annual temperature at Jorhat

Seasons	Vapour pressure (mm of Hg)								Temperatu	
	Morning			Maximum		Evening			Minim	
	N	D	D-N	N	D	D-N	N	D	N	D
Pre-monsoon	17.2	17.4	0.2	28.3	28.4	0.1	18.5	19.4	18.6	19.2
Monsoon	23.0	24.2	1.2*	31.0	32.0	1.0*	25.1	26.1	24.8	25.5
Post-monsoon	17.5	17.8	0.3	28.8	28.5	-0.3	18.5	20.1	18.5	19.2
Winter	11.4	11.5	0.1	23.4	23.5	0.1	10.5	10.8	10.5	10.8
Annual	17.3	17.7	0.4	28.4	28.4	0.0	18.2	19.1	18.2	19.1
Annual	18.0	18.1	0.1	29.3*	29.3*	0.0	19.1	19.8	19.1	20.4

D = Decade (1991-2000) N = Normal (1970-1990)
* Significant at 5 % level ** Significant at 10 % level

Table 3: Variation of seasonal and annual VP, BSSH and evaporation at Jorhat

Seasons	Vapour pressure (mm of Hg)								Temperatu	
	Morning			Maximum		Evening			Minim	
	N	D	D-N	N	D	D-N	N	D	N	D
Pre-monsoon	17.2	17.4	0.2	28.3	28.4	0.1	18.5	19.4	18.6	19.2
Monsoon	23.0	24.2	1.2*	31.0	32.0	1.0*	25.1	26.1	24.8*	25.5
Post-monsoon	17.5	17.8	0.3	28.8	28.5	-0.3	18.5	20.1	18.5	19.2
Winter	11.4	11.5	0.1	23.4	23.5	0.1	10.5	10.8	10.5	10.8
Annual	17.3	17.7	0.4	28.4	28.4	0.0	18.2	19.1	18.2	19.1
Annual	18.0	18.1	0.1	29.3*	29.3*	0.0	19.1	19.8	19.1	20.4

D = Decade (1991-2000) N = Normal (1970-1990)
* Significant at 5 % level ** Significant at 10 % level

season VP increased by 0.2 and 0.6 mm of Hg, respectively (Table 3). The deviations during monsoon and winter were found to be significant.

On the other hand, evening VP had increased in all the months except in January and October during the decade than their normal values. The increase was found to be significant from April to August and November. On seasonal basis in all the four seasons the evening VP increased during the decade (Table 3) with significant values during pre-monsoon and monsoon season. The mean annual evening VP increased by 0.7 mm of Hg during the decade 1991-2000 Simultaneous increase in surface temperature and vapour pressure make the summer sultrier.

Sunshine hours

The BSSH during the decade were found to decrease in all months except in July, November and December (Table. 3). The deviations were found to be significant in the months of March, May, June and August only. It is interesting to note that during these months there was decrease in rainfall indicating more cloudy periods without rainfall. Such a situation also contributes to increase in minimum temperature (Table 2) during these months. On seasonal basis, excepting post-monsoon season, which showed no variation in BSSH, all the other three seasons showed decrease in sunshine hours from normal values. A significant decrease of sunshine hours during pre-monsoon and monsoon seasons is evident. On annual basis BSSH was found to decrease significantly by 142.8 hours compared to the normal value during 1991-2000.

Evaporation

Monthly total evaporation decreased during all the months in the decade (Table 3). Except for January and December, in all the other months the decrease was found to be significant. In spite of increasing maximum and minimum temperatures during the period, a decrease of evaporation might be due to increase in VP. On seasonal and annual basis the evaporation decreased from their corresponding normal values

significantly during the decade.

CONCLUSION

Significant variations were noticed in temperature and rainfall at Jorhat during 1991-2000. Warming of winter months and increasing tendency of September and October rainfall may affect planning *rabi* crops. Decrease of rainfall in entire Assam in recent past has been reported (Nath and Deka, 2002; Nath and Bora, 1994; Govind Rao, 1993). It is seen that the minimum temperature of this region showed a net increase during the decade. Moreover, an increase of water vapour content in the atmosphere is evident which might intensify the green house effect. Many factors such as urbanization, increase in consumption of fossil fuels, rapid growth of population and deforestation may have their own contributions towards these observed variations.

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