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Rainfall and temperature trend analysis in the red and lateritic zone of West Bengal

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ABSTACT

Due to inherent problems of water holding capacity of soil in the red and lateritic zone, the trend of climate change was assessed. Twenty rain gauge stations covering three districts (namely Bankura, Birbhum and Purulia) in the zone were considered to study the rainfall pattern. An increasing trend of yearly rainfall and shifting pattern of rainfall were observed in the said zone as a whole. The rainfall during May decreased in most of the selected stations, where as in October the rainfall amount increased in 75 % cases and in November it increased in 95 % cases. Analysis of maximum temperature data shows that average monthly temperature of summer months (April – May) of 1990-2000 decreased marginally compared to that of 1970-80 .The minimum temperature of the zone, as a whole shows an increasing trend.

Key words : Rainfall, temperature, trend analysis

The economic condition of West Bengal depends mostly on agriculture. Despite increased grain yield through green revolution, the agricultural scenario of the state is still heavily dependent on annual rainfall and rainfall distribution pattern. So, studying rainfall and its variability is becoming important for agricultural production and management. It was noticed that monsoon rainfall does not follow any definite trend in all India scale (Mooley and Partha, 1984; Kripalani *et al.*, 2003) although some significant trends exist in some pockets of India when long term data are analysed (Kolli *et al.*, 1992). West Bengal is comprised of six different agro-ecological zones, of which red and lateritic zone is very much vulnerable to any change in weather parameters due to inherent problems of water holding capacity of soil (Milly, 1994; Milly and Dunne, 1994). The zone is largely under with rainfed agriculture. During monsoon season around 20 % area of Aman paddy cultivated in this state is covered by this zone. However, during post monsoon season and afterwards the zone contributes only around 5% area under Boropaddy and around 10% area under potato and mustard due to lack of irrigation facilities. Besides, this zone experiences wider range of both maximum and minimum temperatures.

The third assessment report of the Inter Governmental Panel on Climate Change (IPCC) shows that the climate may warm globally by 1.4 to 5.8 ^{O}C in the next 100 years. Over the Indian region, it may be restricted to 1.4 ± 3 ^{O}C in the 2020 (IPCC, 2001). As the cropping pattern of any region is solely governed by both rainfall and temperature distributions the study was carried out to find the trends in rainfall and temperature in the vulnerable zone (Red and Lateritic zone) of West Bengal.

MATERIALS AND METHODS

The present study was carried out over the western part of West Bengal, which extendede from 85.84^{O} – 87.87^{O} N and 22.65^{O} – 24.58^{O}E. Twenty rain gauge stations covering three districts (namely Bankura, Birbhum and Purulia) were taken as the representative of the Red and Laterite zone of West Bengal. Daily rainfall for the period of 1970 to 2000 for the months of May to November and yearly total rainfall were analysed decade wise. The monthly average of maximum and minimum temperatures were analysed to determine the trend. The climate of the study area was analyzed by calculating the mean, Standard deviation, coefficient of variations for all stations.

RESULTS AND DISCUSSION

Rainfall analysis

In case of rainfall an increasing trend of yearly rainfall and shifting pattern of rainfall distribution are observed in the said zone as a whole. The average yearly rainfall of 1990 – 2000 increased by 81 mm to 837 mm compared to the average for the period of 1970-80 (Table 1). The decadal variation of annual rainfall in Kashipur and Para stations was at quite high (CV>20%). Manbazar and Mollarpur stations registered moderate level of variability (Sd-127 to 164 mm, CV=12 to 15%) of rainfall. In general, in rest of the stations the coefficient of variation was at lower level (<10%). The shifting pattern of rainfall at two representative stations from each district is presented in Fig. 1. The rainfall during May decreased slightly in several location, where as in October the rainfall increased in 75 % cases and in

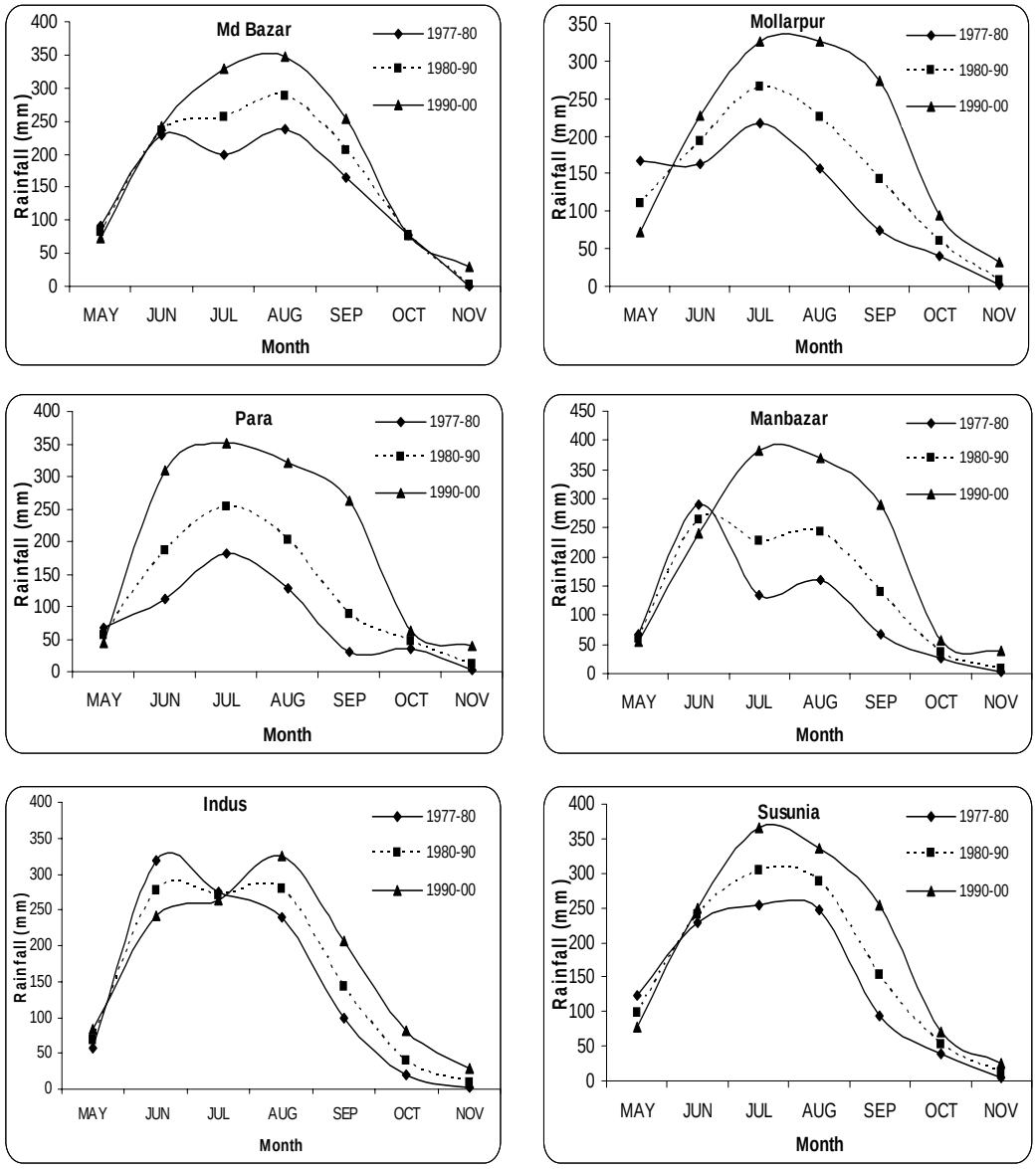

Fig. 1: Monthly rainfall pattern averaged for ten years in Birbhum (Md Bazar, Mollarpur), Purulia(Para, Manbazar) and Bankura(Indus, Susunia) districts

November it increased in 95 % cases. During the months July to September the difference in monthly rainfall was higher in Birbhum and Purulia districts. In Bankura district the increase was marginal.

Temperature analysis

Analysis of temperature data shows that the decreasing trend of maximum temperature is observed in almost all months. Only in few stations like Bankura the maximum temperature increased in the month of June and subsequent months, which may be due to decrease of rainfall amount in that time period (Fig. 2). The minimum temperature of the zone, as a whole shows an increasing trend (Fig. 3). For e.g. in Bankura monthly minimum temperature in January increased by $1^{O}C$ and in Asansole by $0.5^{O}C$. In contrast, Purulia station showed a decreasing trend of minimum temperature throughout the year. Average monthly temperature of summer months (April – May) of 1990-2000 decreased marginally (Sd within 1, CV within 2 %) compared to that of 1970-80 (Table 2). So, the monthly mean temperature does not show any appreciable change during the study period.

Table 1: Average yearly total rainfall (mm) of different stations in Red and Lateritic zone of West Bengal

Stations	Year			Standard deviation	CV (%)
	1970-80	1980-90	1990-200		
Baghmundi	1093.3	1154.0	1333.0	58.7	4.9
Hathwara	1151.2	1203.6	1314.4	39.3	3.2
Jhalda	1185.8	1280.9	1449.3	62.9	4.8
Manbazar	743.6	978.3	1431.1	164.7	15.7
Hura	1240.6	1260.7	1382.1	36.1	2.8
Kashipur	571.8	855.4	1364.6	189.4	20.3
Para	556.1	841.4	1393.1	200.6	21.6
Dubrjpur	1041.9	1111.8	1332.7	71.6	6.2
Bolepur	685.9	811.3	1131.0	108.2	12.4
Illambazar	1062.9	1126.8	1346.7	70.2	6.0
Labhpur	1144.5	1123.6	1225.6	25.4	2.2
Md bazar	999.0	1144.2	1354.7	84.3	7.2
Mollar pur	820.1	1006.8	1351.5	127.1	12.0
Nalhati	1025.4	1155.4	1335.2	73.3	6.3
Nanoor	875.1	1038.9	1323.4	106.9	9.9
Rampurhat	1416.6	1336.0	1357.8	19.7	1.4
Susunia	991.7	1149.2	1380.4	92.1	7.9
Bankura	1265.4	1269.8	1400.1	36.1	2.7
Indus	1009.3	1086.4	1231.4	53.1	4.8
Joyrambati	1398.7	1315.6	1283.9	27.9	2.1

Table 2: Average monthly temperature (^{O}C) of some selected station during the study period

Station	April			Sd	CV(%)	May			Sd	CV(%)
	1970-80	1980-90	1990-2000			1970-80	1980-90	1990-2000		
Bankura	39.1	37.9	37.1	0.5	1.2	39.1	38.8	38.8	0.1	0.2
Purulia	38.4	38.2	38.3	0.0	0.1	39.0	38.2	37.8	0.3	0.8
Shantiniketon	37.3	37.3	37.6	0.1	0.2	37.4	36.6	36.1	0.3	0.8
Asansole	38.3	37.8	37.6	0.2	0.4	38.2	37.0	36.3	0.5	1.2
Burdwan	37.5	36.1	35.1	0.6	1.6	37.8	36.5	35.6	0.5	1.4

CONCLUSION

As the rainfall pattern is shifting the date of sowing of *kharif* paddy (Aman rice) can be shifted to cope up with the changing scenario. The change in rainfall pattern change may affect the extent of soil erosion. During the end of monsoon season (October-November) when the soil is already saturated with water, little more rain will accelerate sheet erosion. By utilizing November rainfall crops with low water requirement (Red gram, kalai etc) may be adopted after kharif season. Moreover, onset of monsoon the rainfall may get delayed in which case optimum showing window based on the changed climatic scenario should be assessed.

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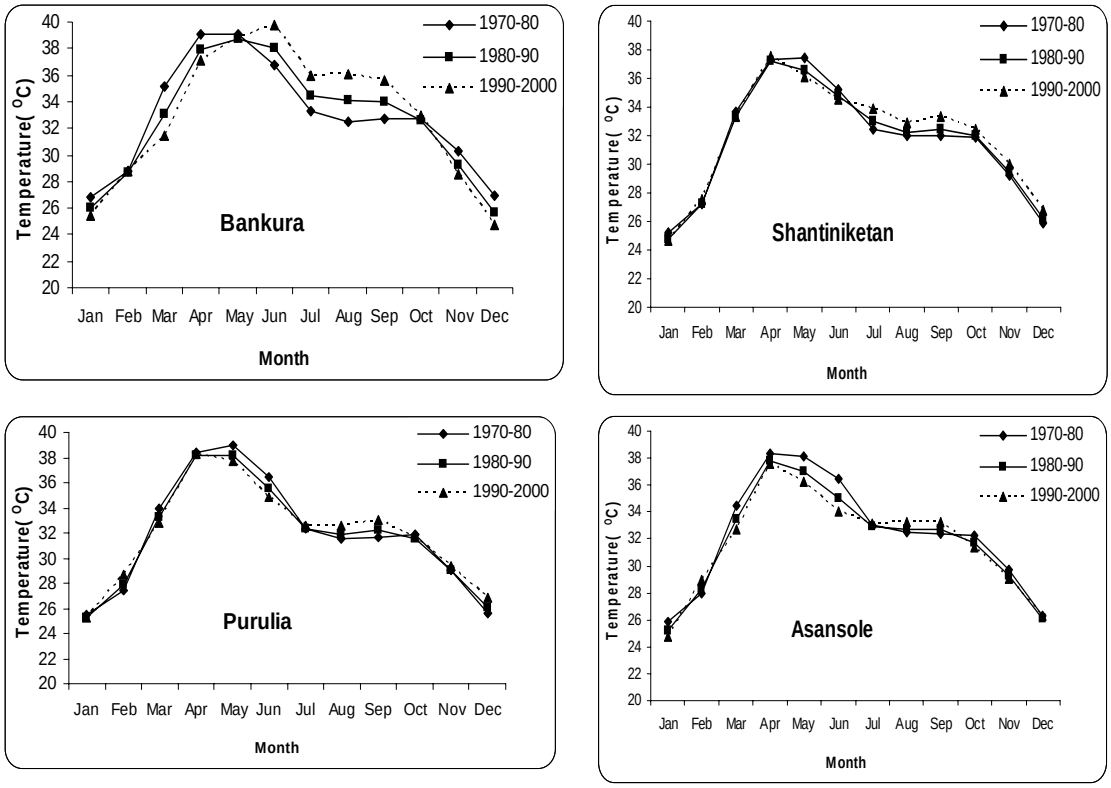

Fig. 2: Maximum temperature trend in some selected station during the study period

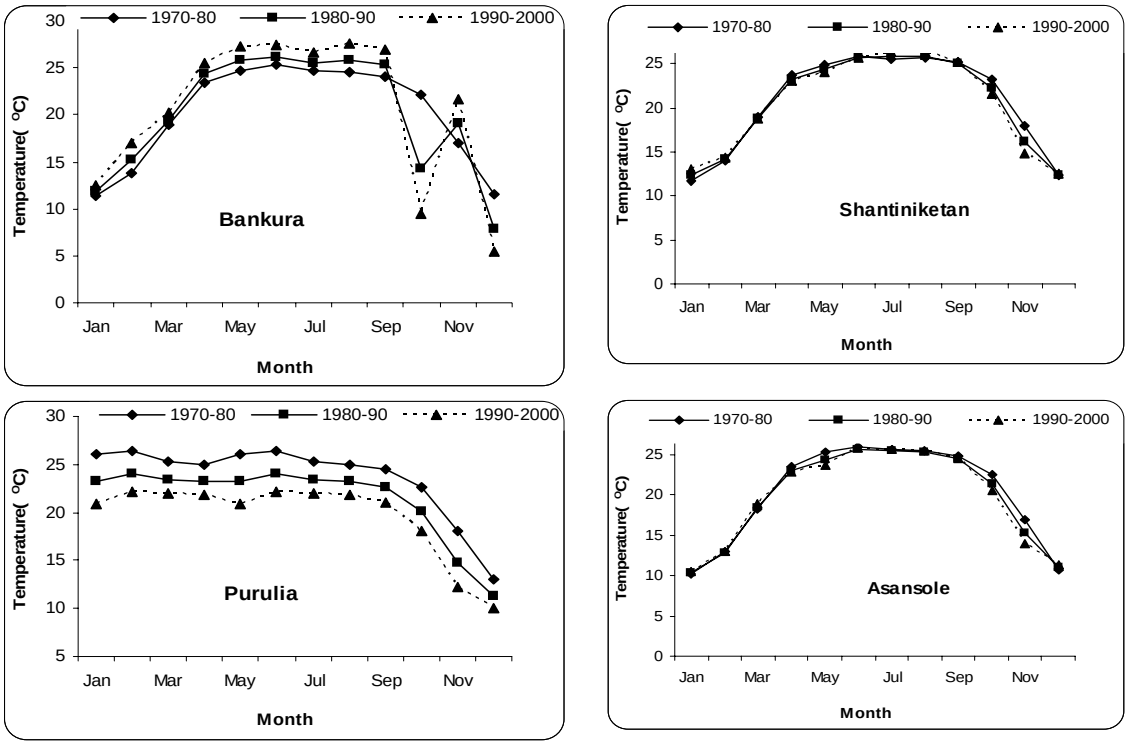

Fig.3: Minimum temperature trend in some selected station during the study period

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