



EXTREME RAINFALL EVENTS ANALYSIS FOR UPPER BRAHMAPUTRA VALLEY AGROCLIMATIC ZONE (UBVZ) OF ASSAM

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Abstract: *The amount of rainfall received over an area is an important factor in assessing availability of water to meet various demands for agriculture, industry, irrigation, generation of hydroelectricity and other human activities. Over the study period of recent 30 years, trend values of monsoon average rainfall in UBVZ have decreased. Consecutive Dry Days (CDD) was maximum in Sibsagar (52.5) followed by Tinsukia (48.9) over the study period. Monthly maximum consecutive 5-day precipitation was maximum in Dibrugarh (256.2mm) followed by Tinsukia (226.4mm).*

Keywords: *Agriculture, Extreme rainfall events, Consecutive dry days, Percentile.*

Introduction

Monsoon rain has always been of a great significance in the North-Eastern (NE) region of India; as agriculture of this region mostly depends upon the natural water resources. The NE region is the breeding ground for a larger number of extreme rainfall events responsible for frequent hydrological disasters like flash floods (Goswami et al., 2010). Information of trend of occurrence of extreme events of any given location helps in proper understanding of their probable impact on day-to-day activities of human beings, livestock and crop production. However, no good documentation of the space-time distribution of extreme rain events exists over this region because of lack of good high-resolution rainfall data. A high-resolution daily $1^\circ \times 1^\circ$ gridded data set has been constructed by Rajeevan et al. (2006) for the period 1951–2004 based on 1803 stations distributed over the country. This data set was used by Goswami et al. (2006) to demonstrate that both the frequency of occurrence and intensity of extreme rain events over the central India (CI) showed a significant increasing trend, while low and moderate events exhibited a significant decreasing trend over the past 50 years. Thus, in recent decades in India, many authors have analysed extreme rainfall series for periods of different lengths, using data

from different rain-gauge networks and a variety of methods (Rakhecha and Soman 1994; Dhar and Nandargi 1995; Roy and Balling 2004; Goswami et al. 2006; Rajeevan et al. 2008; Guhathakurta et al. 2011). Francis and Gadgil (2006) studied intense rainfall events along the west coast of India and concluded that most of the extreme events are associated with large scale organized convective activity and that the northward propagating tropical convergence zone (TCZ) provides the large scale environment over which a large fraction of these events occur. Climate model studies also shows that an increase in global surface temperature, as a result of the increase in greenhouse gases, can lead to an increase in the magnitude and frequency of extreme rainfall events (Hennessey et al. 1997; Meehl et al. 2000; Trenberth et al. 2003; IPCC, 2007).

The present study *i.e.* UBVZ comprises of five districts, *viz.* Golaghat (26.52° N and 93.96° E), Jorhat (26.74° N and 94.20° E), Sibsagar (26.98° N and 94.64° E), Dibrugarh (27.47° N and 94.91° E) and Tinsukia (27.49° N and 95.34° E). This zone has a geographical extent of 5561 sq. km (7.08% of total geographical area of Assam). This is an important area of Assam and known for diversified cropping with rice as the main crop. Apart from rice (Ahu, Sali and Boro) toria, potato, sugarcane and jute are other

main crops, which are grown extensively here. The region receives an average annual rainfall of 2,300 mm (Goswami, 1998). Climate is humid to per humid and dominated by fertile alluvial soils. A large amount of the variability of rainfall is related to the occurrence of extreme rainfall events and their intensities. Therefore, there is a need to know the magnitudes of extreme rainfall events over different parts of the area under study.

Materials and Methods

Extreme rainfall analysis of five districts of Upper Brahmaputra Valley Zone of Assam i.e. Tinsukia, Dibrugarh, Sivasagar, Jorhat and Golaghat districts have been analysed using software 'Rclimdex 1.1'. 30 years rainfall data from 1981 to 2010 were used for analysis. Eleven nos of extreme rainfall events were considered for analysis (Table 1). Trend of the parameters have been compared along with their slope and significance.

Table 1: Eleven nos of extreme rainfall events

Sl. No.	Parameter	Indicator's name	Definition	Unit
1	RX1day	Max 1-day precipitation amount	Monthly maximum 1-day precipitation	mm
2	Rx5day	Max 5-day precipitation amount	Monthly maximum consecutive 5-day precipitation	mm
3	SDII	Simple daily intensity index	Annual total precipitation divided by the number of wet days (defined as PRCP>=1.0mm) in the year	mm/day
4	R10mm	Number of heavy precipitation days	Annual count of days when PRCP>=10mm	days
5	R20mm	Number of very heavy precipitation days	Annual count of days when PRCP>=20mm	days
6	R75mm	Number of days above 75 mm precipitation	Annual count of days when PRCP>=75 mm, nn is user defined threshold	days
7	CDD	Consecutive dry days	Maximum number of consecutive days with RR<1mm	days
8	CWD	Consecutive wet days	Maximum number of consecutive days with RR>=1mm	days
9	R95p	Very wet days	Annual total PRCP when RR>95 th percentile	mm
10	R99p	Extremely wet days	Annual total PRCP when RR>99 th percentile	mm
11	PRCPTOT	Annual total wet-day precipitation	Annual total PRCP in wet days (RR>=1mm)	mm

Result and discussion:

Highest mean values of various extreme rainfall parameters have been noticed for Dibrugarh district including total annual wet day precipitation, except for maximum nos. of consecutive dry days (CDD). Dibrugarh is followed by Tinsukia, Sivasagar, Jorhat and Golaghat. Among different

districts Sivasagar experiences highest value of CDD and lowest value of consecutive wet days (CWD). Amount of annual precipitation in wet days (PRCPTOT) is ranging between 2605.9 mm (Dibrugarh) and 1693.8 mm (Golaghat) with in the UBZ (Table 2).

Table 2: District wise mean values of different extreme event parameters for UBZ, Assam

Parameter	Unit	District wise mean values				
		Golaghat	Sivasagar	Tinsukia	Jorhat	Dibrugarh
RX1day	mm	95.3	105.3	111.7	96.8	118.3
Rx5day	mm	173.1	211.3	226.4	173.9	256.2

SDII	mm/day	13.3	17.5	16.7	14.0	17.2
R10mm	days	52.3	67.7	74.9	57.1	77.0
R20mm	days	27.1	36.4	42.4	29.9	44.7
R75mm	days	1.6	2.65	3.1	1.9	3.9
CDD	days	44.2	52.5	48.9	41.3	39.5
CWD	days	11.2	10.8	16.7	11.5	16.9
R95p	mm	436.0	396.8	576.8	467.8	639.0
R99p	mm	95.2	116.1	180.1	142.6	196.2
PRCPTOT	mm	1693.8	2167.0	2469.4	1861.8	2605.9

Table 3: District wise magnitude of change (slope) & trend of different extreme event parameters for UBVZ, Assam

Parameter	Unit	District wise slope & trend				
		Golaghat	Sivasagar	Tinsukia	Jorhat	Dibrugarh
RX1day	mm	-0.107	-0.030	-0.379	-0.341	0.188
Rx5day	mm	-1.323	-1.410	-0.905	-0.706	0.602
SDII	mm/day	0.016	-0.233	-0.008	-0.045	0.011
R10mm	days	-0.227	-0.803	0.080	-0.190	0.003
R20mm	days	-0.099	-0.526	0.046	-0.217	-0.143
R75mm	days	-0.018	-0.052	-0.021	-0.019	0.050
CDD	days	0.869	0.567	0.541	0.270	0.485
CWD	days	-0.055	-0.051	0.065	-0.067	-0.129
R95p	mm	-0.753	-9.314	-4.724	-1.982	-1.249
R99p	mm	-2.903	-2.168	-0.762	-1.996	0.899
PRCPTOT	mm	-6.413	-27.888	-0.352	-7.342	-3.838

The slope of the parameters indicates the magnitude of change over time and the positive or negative sign indicates the direction of the change (Table 3). Monthly maximum 1-day (RX1day) and 5-days (RX5day) precipitation shows positive trend only in case of Dibrugarh district. Similar is the case with 'annual count of days when PRCP \geq 10mm' (R10mm) and 'annual count of days when PRCP \geq 75mm' (R75mm). At the same time CWD for Dibrugarh is showing a negative trend. This indicates the Dibrugarh is experiencing more intense rainfall events, where as its nos. of rainy days are decreasing in last 30 years. The only district which is showing a slight positive trend of CWD (0.065) is Tinsukia, but it is likely to become negative in near future as the CDD has a higher positive value of 0.541. Tinsukia is also maintaining a positive trend for low intensity rainfall events (R10mm and R20mm). Simple daily intensity index (SDII) of rainfall shows positive trend only in case of Golaghat

and Dibrugarh. Rate of change of amount of annual precipitation in wet days (PRCPTOT) is negative for all the districts. Sivasagar is losing PRCPTOT at an alarming rate of -27.888 mm/year, followed by Jorhat (-7.342 mm/year), Golaghat (-6.413 mm/year), Dibrugarh (-3.838 mm/year) and Tinsukia (-0.352 mm/year).

Conclusion

Highest mean values of various extreme rainfall parameters have been noticed for Dibrugarh district including total annual wet day precipitation. Dibrugarh is experiencing high intensity rainfall events in last 30 years which may cause flood, landslides etc. Tinsukia is also maintaining a positive trend for low intensity rainfall events (R10mm and R20mm). Overall, Dibrugarh and Tinsukia are better placed than other three districts with respect to rainfall status in Upper Brahmaputra Valley Agroclimatic Zone of Assam.

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