Spatio-temporal Rainfall Analysis for Crop Planning in Barak Valley of North East of India

By

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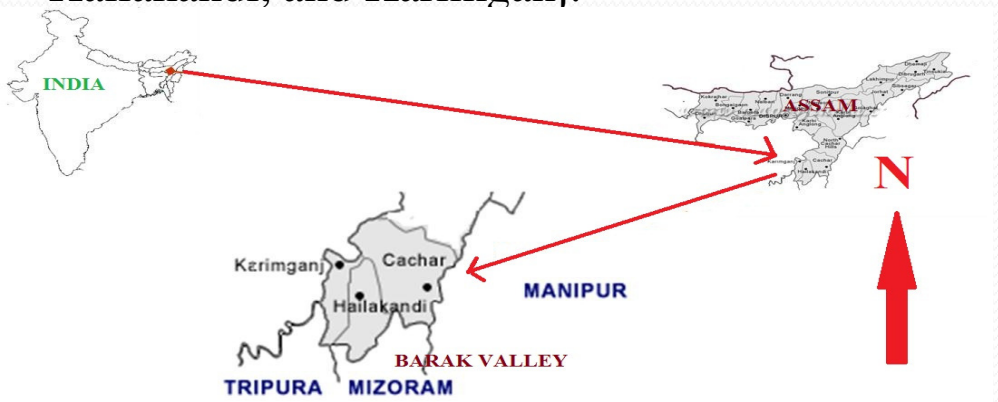
OBJECTIVES

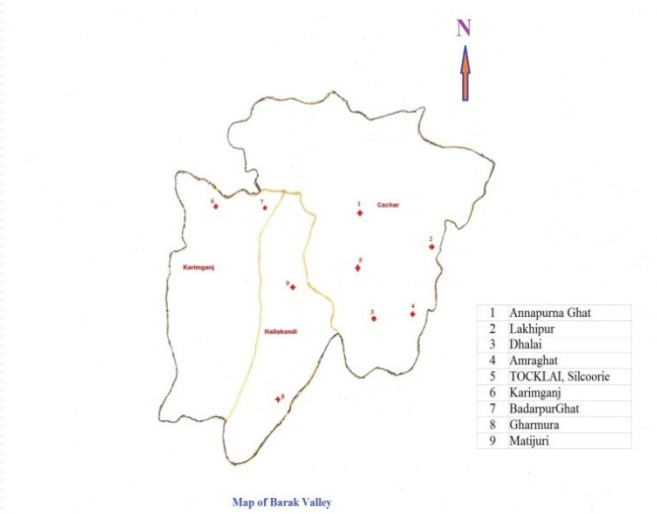
- Spatial and temporal analysis of rainfall data of the Barak Valley.
- Statistical and probability analysis of rainfall for crop planning.
- Planning for High-tech agricultural practices

MATERIALS AND METHODS

Study Area

- Barak valley (latitude 24°8′ to 25°8′ N and longitude 92°15′ to 93°15′ E and with altitude of 31.40 m from the mean sea level) of Assam State, India
- Geographical area of 6,922 km^2 (8.84% of state) with three districts, viz. Cachar, Hailakandi, and Karimganj.





Map of Barak Valley

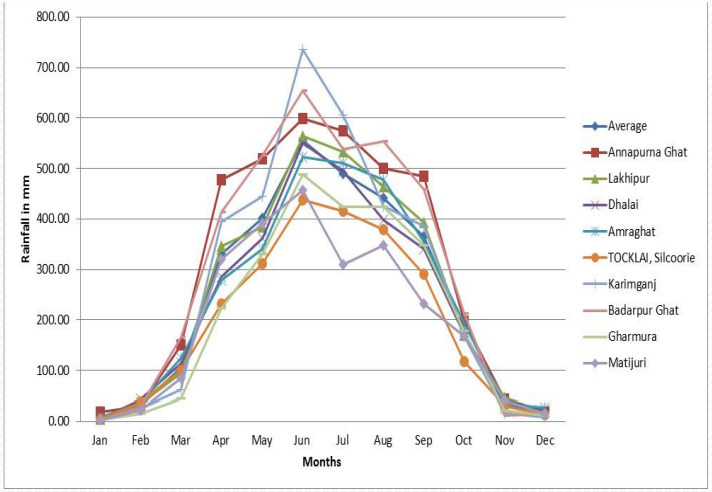
Data Monitoring and Rainfall Analysis

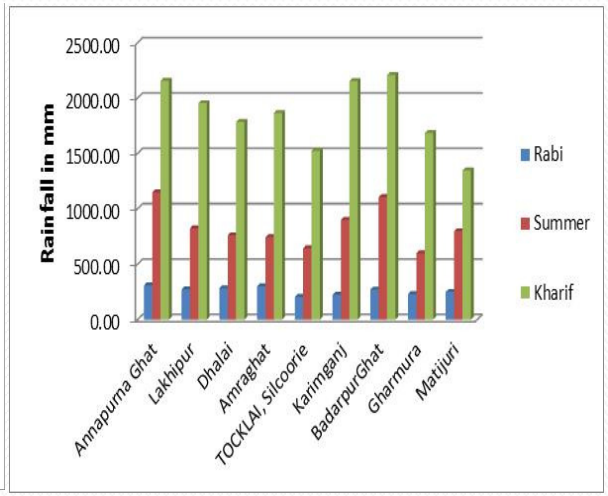
- The study area is covered by nine rain gauge stations in the Barak valley (Annapurna Ghat, Lakhipur, Dhalai, Amraghat, Silcoorie located in Cachar district; Karimganj and Badarpur Ghat in Karimganj district; and Gharmura and Matijuri located in Hailakandi district).
- The rainfall data were collected on daily basis for nine numbers of rain gauge stations in the valley.
- The spatial variability of rainfall considers the pattern of rainfall in different stations, and the valley and the temporal variability of rainfall considers the long term variation in monthly, seasonally (Summer, Kharif and Rabi) and yearly basis.
- Probability analysis was carried out using the SMADA (Stormwater Management and Design Aid, version 6.0) software.

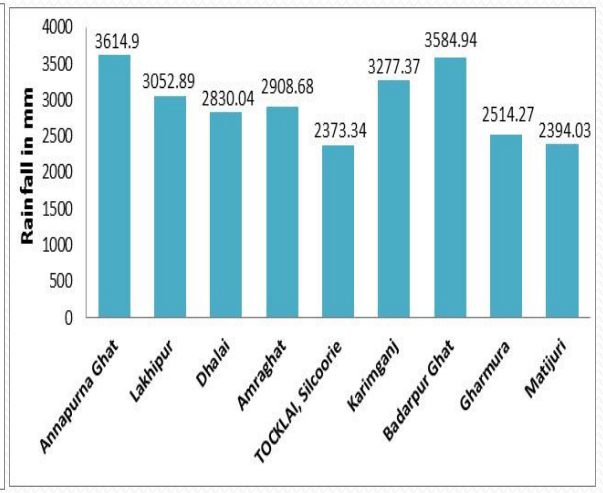
RESULTS AND DISCUSSION

Spatial and Temporal Rainfall Analysis

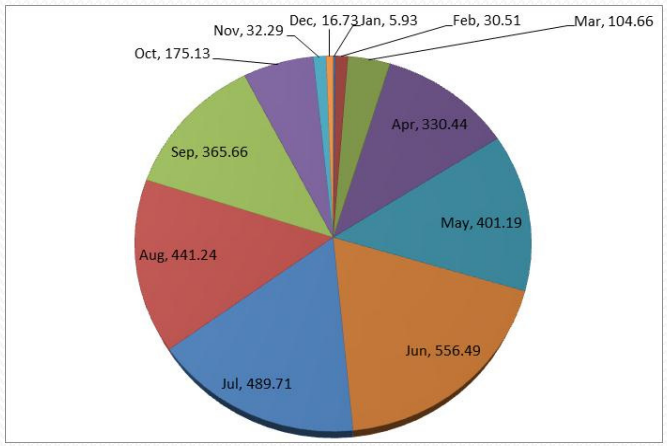
Station-wise monthly, seasonal and annual rainfall variation in Barak Valley

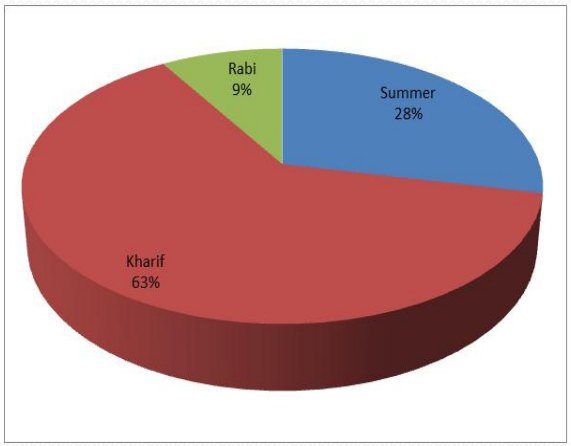






Average monthly variation and seasonal contribution of rainfall in Barak Valley



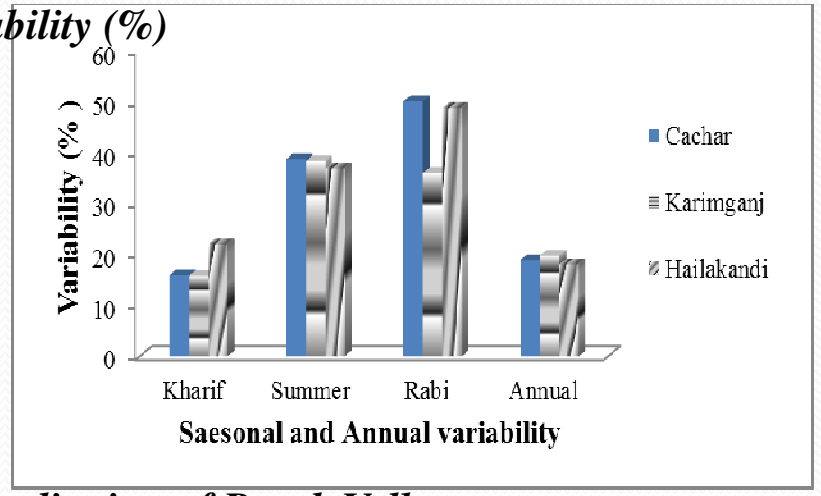


RESULTS AND DISCUSSION (CONTD.)

Rainfall variability and statistics

Station and district-wise seasonal and annual rainfall variability (%)

Station Name	Rainfall Variability (%)			
	Summer	Kharif	Rabi	Annual
Annapurna Ghat	44.98	22.81	47.34	26.23
Lakhipur	55.40	18.95	59.19	25.24
Dhalai	34.52	18.40	52.20	18.85
Amraghat	40.38	16.93	55.50	18.65
Silcoorie	34.19	15.48	50.27	15.46
Karimganj	43.22	21.31	51.87	24.37
Badarpur Ghat	35.83	18.21	31.05	19.97
Gharmura	51.28	14.60	46.89	16.45
Matijuri	29.36	36.13	55.99	24.95



Seasonal and annual statistical analysis of three districts of Barak Valley.

Parameter	Kharif (Jun –Sep)	Summer (Mar – May)	Rabi (Oct – Feb)	Annual
Cachar				
Mean Rainfall (mm)	1857.13	824.53	**274.19**	2955.97
% of Contribution	62.83	27.89	9.28	100
Standard Deviation	232.62	192.41	40.70	447.53
CV (%)	12.53	23.34	14.84	15.14
Karimganj				
Mean Rainfall (mm)	**2180.49**	**1003.43**	247.24	**3431.16**
% of Contribution	63.55	29.24	7.21	100
Standard Deviation	37.95	145.47	34.07	217.48
CV (%)	1.74	14.50	13.78	6.34
Hailakandi				
Mean Rainfall (mm)	1515.65	698.58	239.93	2454.16
% of Contribution	61.76	28.47	7.78	100
Standard Deviation	239.12	140.08	14.01	85.02
CV (%)	15.78	20.05	5.84	3.46
Barak valley				
Mean Rainfall (mm)	1853.10	836.29	260.59	2950.05
% of Contribution	62.82	28.35	8.83	100
Standard Deviation	299.43	188.20	35.56	475.74
CV (%)	16.16	22.50	13.65	16.13

Monthly statistical analysis of three Districts and entire Barak Valley

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cachar													
Mean Rainfall (mm)	8.30	36.48	116.74	324.10	383.68	534.67	505.99	443.44	373.03	169.72	39.27	20.42	2955.97
% of Contribution	0.28	1.23	3.95	10.96	12.98	18.09	17.12	15.00	12.62	5.74	1.33	0.69	100.00
Standard Deviation	13.36	37.19	92.17	240.10	113.73	169.82	98.06	147.80	154.93	82.98	39.37	41.83	561.46
CV (%)	160.96	101.96	78.95	74.08	29.64	31.76	19.38	33.33	41.53	48.89	100.26	204.89	18.99
Karimganj													
Mean Rainfall (mm)	2.63	27.85	114.26	404.19	484.99	695.18	572.33	490.34	422.64	190.55	14.97	11.25	3431.16
% of Contribution	0.08	0.81	3.33	11.78	14.13	20.26	16.68	14.29	12.32	5.55	0.44	0.33	100.00
Standard Deviation	5.27	32.48	81.49	277.23	137.60	202.56	192.24	143.58	158.48	68.61	17.80	19.09	677.16
CV (%)	200.33	116.63	71.32	68.59	28.37	29.14	33.59	29.28	37.50	36.01	118.95	169.74	19.74
Hailakandi													
Mean Rainfall (mm)	3.30	18.24	64.85	272.54	361.19	472.36	366.40	386.63	290.27	173.23	32.19	12.98	2454.15
% of Contribution	0.13	0.74	2.64	11.11	14.72	19.25	14.93	15.75	11.83	7.06	1.31	0.53	100.00
Standard Deviation	7.57	27.66	48.04	227.86	134.02	222.83	148.56	142.51	84.59	68.87	42.39	32.72	442.44
CV (%)	229.70	151.62	74.07	83.61	37.11	47.18	40.55	36.86	29.14	39.76	131.71	252.06	18.03
Barak valley													
Mean Rainfall (mm)	4.74	27.52	98.62	333.61	409.95	567.40	481.57	440.13	361.98	177.83	28.81	14.88	2947.09
% of Contribution	0.16	0.93	3.35	11.32	13.91	19.25	16.34	14.93	12.28	6.03	0.98	0.50	100.00
Standard Deviation	7.94	31.04	62.18	240.85	109.35	169.47	120.40	115.84	99.99	59.55	31.69	30.53	446.90
CV (%)	167.55	112.79	63.05	72.20	26.67	29.87	25.00	26.32	27.62	33.49	110.01	205.14	15.16

RESULTS AND DISCUSSION (CONTD.)

Station-wise maximum, minimum and annual average rainfall in the Barak Valley

Raingauge Station	Occurrence of Maximum Rainfall		Occurrence of Minimum Rainfall		Average Annual Rainfall (mm)
	Year	Amount (mm)	Year	Amount (mm)	
Annapurna Ghat	2005	5155.30	2006	2235.90	**3614.90**
Lakhipur	2010	4674.90	2002	2029.90	**3052.89**
Dhalai	2010	3644.80	2006	1881.20	**2830.04**
Amraghat	2010	3809.00	2006	2017.80	**2908.68**
Silcoorie	2010	3082.70	2006	1875.30	**2373.34**
Karimganj	2004	4259.40	2008	1596.10	**3277.37**
Badarpur Ghat	2010	4854.20	2006	2598.50	**3584.94**
Gharmura	2002	2914.10	2009	1697.80	**2514.27**
Matijuri	2007	3053.30	2009	1254.50	**2394.03**

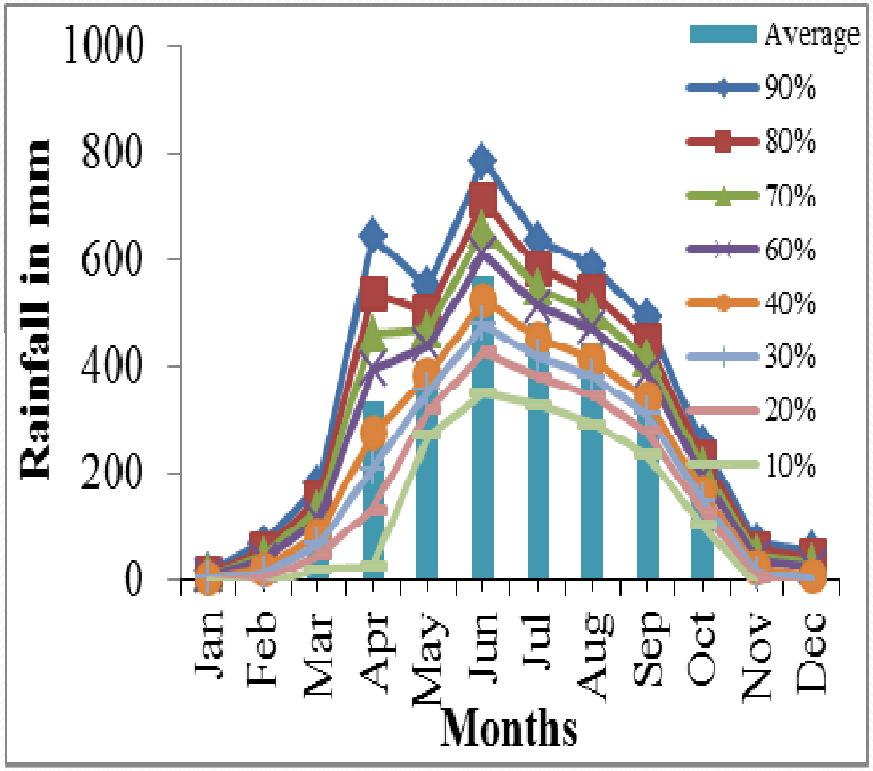
Station-wise mean seasonal and annual rainfall (mm) at different stations in the Barak Valley

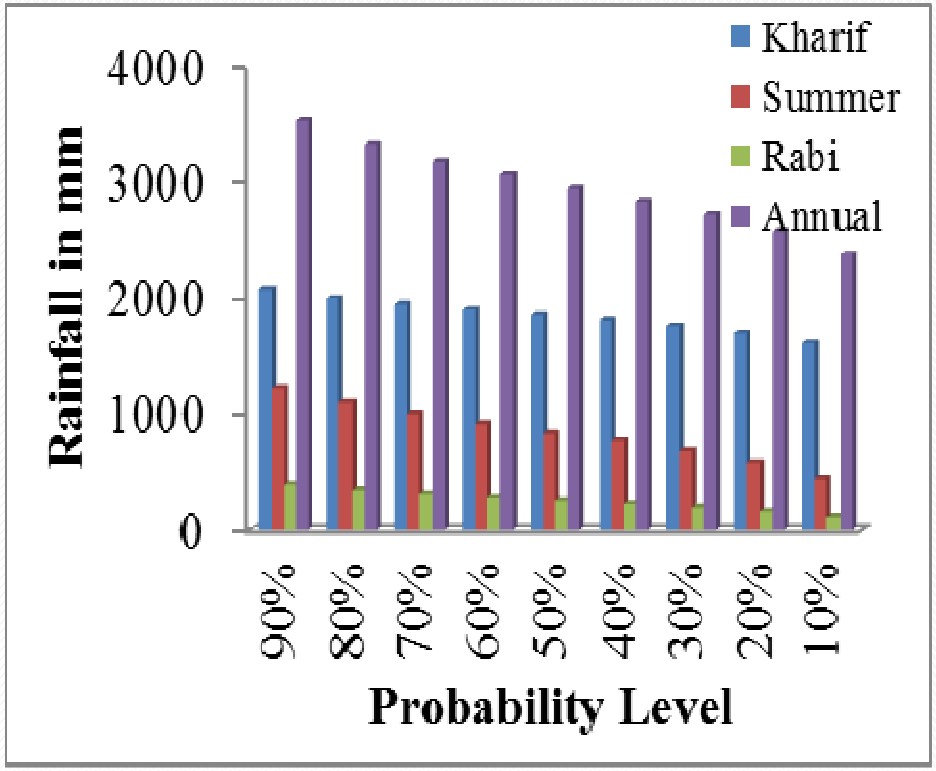
Station Name	Summer (Mar – May)	Kharif (Jun –Sep)	Rabi (Oct – Feb)	Annual (mm)
Annapurna Ghat	1148.81	2157.74	308.35	3614.90
Lakhipur	824.38	1953.87	274.00	3052.89
Dhalai	761.42	1785.52	283.10	2830.04
Amraghat	743.38	1865.34	299.96	2908.68
Silcoorie	644.64	1523.17	205.53	2373.34
Karimganj	900.57	2153.65	223.15	3277.37
Badarpur Ghat	1106.29	2207.32	271.33	3584.94
Gharmura	599.52	1684.73	230.02	2514.27
Matijuri	797.63	1346.56	249.84	2394.03

RESULTS AND DISCUSSION (CONTD.)

Rainfall Probability Analysis

Expected monthly, seasonal and annual rainfall in Barak Valley





CONCLUSION

- Barak valley receives average rainfall of 2950 mm during 2001-2010 which is above normal rainfall of Assam state (2818 mm).
- The heavy rainfall experiences at Karimganj district 3431.16 mm followed by Cachar 2955.97 mm and Hailakandi 2454.15 mm.
- It is observed that highest percentage (62.82% *i.e.* 1853.10 mm) of rainfall contribution to the valley is during kharif season followed by summer season (28.35% *i.e.* 836.29 mm) and rabi season (8.83% *i.e.* 260.59 mm).
- The monthly and seasonal rainfall of the three districts are found so high that at 50 percent and above probability levels there are chance of occurrence of rainfall more than the average rainfall value.

CONCLUSION (CONTD.)

- Hence long duration flood resistance crops for the monsoon and short duration cropping pattern for the non-monsoon season can be followed for increasing the agricultural productivity in the Barak Valley.
- Also rainwater harvesting structures shall be prepared to conserve water for dry spell use.
- Ground water recharge rate is also to be increased so that in dry season ground water can be lifted up and used for irrigation purposes and other domestic purposes.
- During rainy season agricultural practices shall be done in protected cultivation (inside green houses, poly houses or shade net houses) with micro irrigation systems to increase the yield and also to get off seasonal crops, which will give better return on investments.

Thank You