

## L E T T E R S

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### RAINFALL PATTERN OVER PATIALA DURING MONSOON SEASON

1. Patiala is situated at the latitude of 30° - 20' N and longitude of 76° - 28' E at 250 m a.s.l. about 70 km SSW of Chandigarh. It remains generally dry except during the brief monsoon season. 80% of annual rainfall

occurs in the monsoon season only. Hence the study of rainfall pattern over Patiala during the monsoon season assumes significance. The study covers frequency of rainy days during monsoon season, rainfall figures for each month & season as a whole and percentage of departure from normal rainfall for each month & season as a whole (June - September) over a period of 22 years (1989-2010). The data is too short to make any conclusion about the decadal change as well as with respect to any change on long-term basis .

**TABLE 1**

**Frequency of rainy days**

Year	Light Rainfall <7.6 mm	Moderate rainfall <35.6 mm	Rather heavy rainfall <64.5 mm	Heavy rainfall <124.5mm	Very heavy rainfall <244.5mm	Extremely heavy rainfall ≥244.5 mm	Total
1989	09	12	06	01	-	-	28
1990	11	10	08	02	-	-	31
1991	09	12	07	01	-	-	29
1992	12	10	03	-	01	-	26
1993	12	10	04	-	01	0101	28
1994	09	10	12	-	01	-	32
1995	10	12	12	-	02	-	36
1996	15	10	07	01	-	-	33
1997	09	08	03	03	-	-	23
1998	15	10	06	01	-	-	32
1999	12	10	04	-	-	-	26
2000	10	05	05	02	-	-	22
2001	10	07	03	01	-	-	21
2002	09	06	02	-	-	-	17
2003	08	10	08	-	01	-	27
2004	06	04	03	01	01	-	15
2005	05	08	06	-	-	-	19
2006	10	05	04	-	-	-	19
2007	07	06	04	-	-	-	17
2008	15	13	12	02	-	-	42
2009	08	10	04	03	-	-	25
2010	10	12	08	03	-	-	33
<b>Total</b>	<b>221</b>	<b>200</b>	<b>131</b>	<b>21</b>	<b>07</b>	<b>01</b>	<b>581</b>
<b>Average</b>	<b>10.0</b>	<b>9.1</b>	<b>5.9</b>	<b>0.9</b>	<b>0.3</b>	<b>.04</b>	<b>26.4</b>
<b>% of average rainy days</b>		<b>95%</b>			<b>5%</b>		<b>100%</b>

**TABLE 2**  
**Rainfall figures (mm) for each month and season as a whole (June-September)**

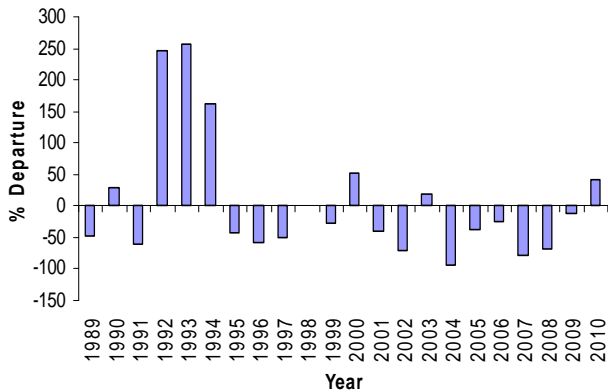
Year	June	July	Aug	Sep	Seasonal Total
1989	33.0	125.0	414.0	96.0	668.0
1990	8.0	307.0	166.0	245.0	726.0
1991	170.0	94.0	285.0	85.0	634.0
1992	68.9	170.1	236.6	76.9	552.2
1993	31.1	842.4	3.1	147.3	1023.9
1994	65.7	615.5	394.6	53.3	1129.1
1995	95.0	135.0	780.0	292.8	1302.8
1996	210.9	99.9	180.0	170.0	660.8
1997	60.5	117.7	374.9	25.9	579.0
1998	140.9	241.3	223.2	250.1	855.5
1999	49.0	172.5	97.7	114.8	434.0
2000	244.0	362.1	43.7	62.6	712.4
2001	109.0	141.0	178.5	20.8	449.3
2002	10.9	68.8	103.2	186.7	369.6
2003	55.0	280.8	216.6	134.2	686.6
2004	51.0	15.9	388.9	11.9	467.7
2005	103.8	146.4	89.7	149.9	489.8
2006	37.1	179.7	86.1	20.6	323.5
2007	43.9	50.5	159.7	33.5	287.6
2008	478.8	77.6	245.5	235.5	1037.4
2009	47.9	206.7	63.0	209.4	527.0
2010	167.8	337.7	139.6	230.0	875.1
Average	103.7	217.6	221.3	129.6	672.3

2. Rainfall normals of Patiala are : June – 49.1 mm, July – 236.2 mm, August – 225.3 mm, September – 118.4 mm and seasonal (June – September) – 629 mm.

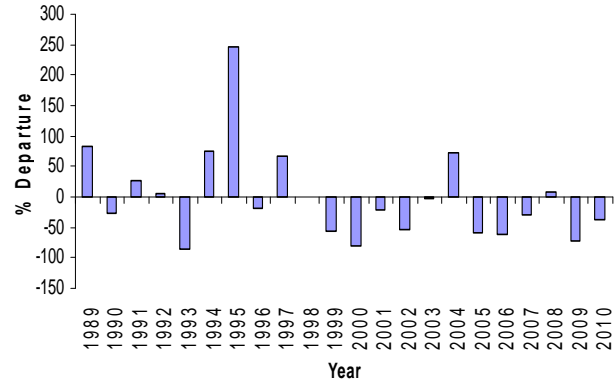
3. Frequency of rainy days during monsoon seasons over the period 1989-2010, under different categories of rainfall is shown in Table 1. Rainfall amounts < 2.5 mm have not been considered for study. It can be inferred that light to moderate & rather heavy mean rainy days are seen 95% and those of heavy to very heavy & extremely heavy rainfall 5% of the total rainy days. Mean number of rainy days during the monsoon season is found to be 26.4. During the period under study an extremely heavy rainfall of 360 mm was reported on 11 July, 1993. This caused disastrous flood at Patiala in which M.O. Patiala was also inundated. Interaction of two

synoptic systems *i.e.*, trough in westerly and LOPAR over Rajasthan was responsible for the unprecedented rainfall of 360 mm on 11 July, 1993. Besides this, there occurred a few spells of very heavy rainfall in some years, but caused no flood-like situation at Patiala. Number of rainy days during monsoon seasons varied from as low as 15 in the year 2004 to as high as 42 in 2008 as shown in Table 1. This interannual variability of seasonal rainy days at Patiala is high with standard deviation of 6.8 days and with coefficient of variability of rainfall being 25 %.

4. Table 2 shows rainfall figures for each month and season as a whole (June – September) for the period 1989-2010. It can be inferred that mostly July or August is seen as the rainiest month of the season. But in the years 1996, 2000 & 2008, June was the rainiest month and in



**Fig. 1.** Percentage of departure from normal rainfall during July (1989-2010)



**Fig. 2.** Percentage of departure from normal rainfall during August (1989-2010)

the years 1998, 2002, 2005 & 2009, September was the rainiest month of the season. The lowest monthly rainfall of 3.1 mm occurred in August 1993 and the highest one of 842.4 mm in July 1993. Seasonal rainfall varied from as low as 287.6 mm in the year 2007 to as high as 1302.8 mm in 1995.

5. Monthly and seasonal rainfall pattern have been also examined and the following is revealed.

(i) For June the variability of rainfall is very high and in the extreme years it can range between  $-78\%$  and  $+875\%$  (Figure not shown) of the monthly average.

(ii) For the monsoon months of July and August year to year departure of rainfall in percentage are shown in Fig. 1. and Fig. 2. For July the highest ( $+257\%$ ) is in the year 1993 and the lowest ( $-93\%$ ) in 2004. During July rainfall departure remained considerably deficient in more number of years *i.e.*, 14 years out of 22 years.

(iii) For the month of August the highest rain ( $+247\%$ ) occurred in the year 1995 and the lowest ( $-33\%$ ) in 1993. During August also rainfall departure remained deficient in more number of years *i.e.*, 12 years out of 22 years.

(iv) Departure of rainfall from average rainfall for the monsoon season as a whole (June-September) is the highest ( $+110\%$ ) in the year 1995 and the lowest ( $-54\%$ ) in 2007. Seasonal rainfall pattern remained excess in 6 years, normal in 8 years and deficient in 8 years, over the period of 22 years. There appears to be some compensation in the rainfall on monthly basis for the total seasonal rainfall.

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