

Occurrence of droughts and floods over Gujarat

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ABSTRACT

Daily rainfall data for ninety years (1901-1990) of all the districts of the state of Gujarat have been analysed to work out the occurrence of drought and floods in the state. Results revealed that about 91-97% of annual rainfall is received in the four months (June to September), out of which July contributes the maximum. The arid region receives rainfall of 500 mm or less in most of the years while humid regions receive more than 1000 mm. However, the droughts and floods are observed in both the regions.

Key Words : Droughts, Floods, Gujarat state

Gujarat state receives about 95% of its annual rainfall through the influence of south-west monsoon. Because of the geographical situation of the state, it is benefited by both the Arabian sea and Bay of Bengal branches of monsoon currents. Some times due to certain synoptic situation none of these currents reaches over the state of Gujarat resulting in delayed onset of monsoon, intermittent dryspell and subsequent drought, while on other occasions these currents cause heavy downpour resulting in floods. Low rainfall areas such as Kutch, Jamnagar, Surendranagar and Banaskantha districts are mainly prone to drought. A few attempts have been made earlier (Virmani, *et al.* 1982; Biswas and Basarkar, 1982; and Pandey and Patel, 1989) to analyse the rainfall data for selected stations of the state. The present study is aimed at to incorporate all the available data for all the districts of Gujarat state.

MATERIALS AND METHODS

Daily rainfall data of more than 300 stations of Gujarat spread throughout the state were obtained from Bureau of Statistics and Economics, Govt. of Gujarat, Gandhinagar, for

the period of 1901 to 1990. These data were checked and corrected. For the present purpose district wise mean rainfall were compiled and analysed. Monthly and seasonal rainfall and their percentage contributions were calculated. Frequency of occurrence of different rainfall ranges were calculated and presented. The drought and flood years with varying intensity were computed using the following criteria.

Normal rainfall year : when annual rainfall is between 75% -125% of mean rainfall

Drought year : annual rainfall less than 75% of mean rainfall

Flood year : annual rainfall higher than 125% of mean rainfall

The percent chances of occurrence of normal rainfall year, drought year and flood years were calculated.

RESULTS AND DISCUSSION

Seasonal distribution of rainfall

The annual mean rainfall in the state

Table 1: Percentage contribution of monthly rainfall in the different districts of Gujarat

District	Months			
	June	July	August	September
Kutch	12	47	26	10
Jamnagar	13	49	18	12
Surendranagar	15	44	23	15
Banaskantha	8	40	34	10
Rajkot	15	43	21	14
Amreli	17	38	19	16
Bhavnagar	17	37	19	17
Mehsana	10	45	27	10
Ahmedabad	13	42	24	15
Junagadh	19	43	19	12
Kheda	12	42	25	16
Sabarkantha	11	41	30	14
Bharuch	15	39	22	18
Vadodara	13	40	24	18
Panchmahal	13	38	27	18
Surat	16	42	23	15
Valsad	14	42	24	16
Dang	12	42	25	16

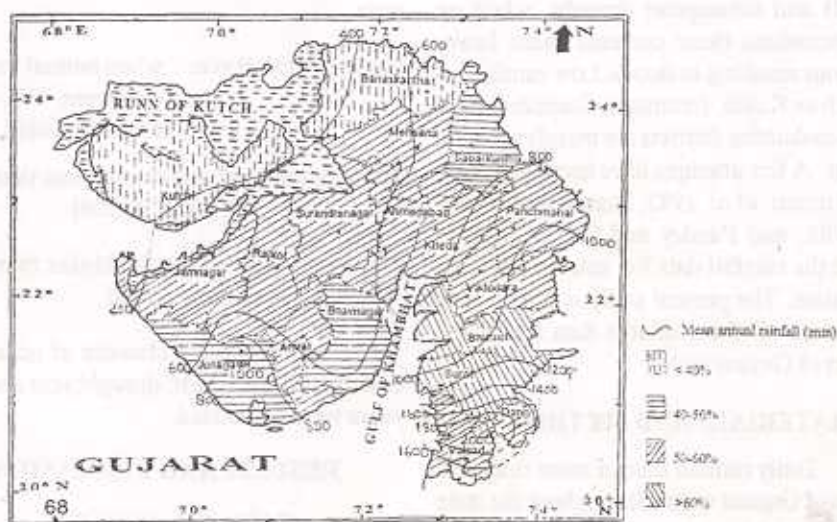
**Fig. 1 :** Percent chances of occurrence of normal rainfall along with the mean annual rainfall

Table 2: Frequency distribution of rainfall in different districts of Gujarat

District	Intervals of rainfall						
	<300mm	301 to 500mm	501 to 750mm	751 to 1000mm	1001 to 1500mm	1501 to 2000mm	>2000 mm
Kutch	31.9	47.2	15.3	5.6	0	0	0
Jamnagar	25.3	36.0	24.0	13.3	1.4	0	0
Surendranagar	13.6	42.1	35.2	8.0	1.1	0	0
Banaskantha	15.3	36.5	29.4	9.4	9.4	0	0
Rajkot	4.9	27.2	48.1	17.3	2.5	0	0
Amreli	7.1	34.1	40.0	12.9	4.7	1.2	0
Bhavnagar	8.0	29.5	35.2	21.6	5.7	0	0
Mehsana	8.3	36.7	33.3	15.0	6.7	0	0
Ahmedabad	8.2	20.0	48.0	18.8	4.7	0	0
Junagadh	7.0	20.9	31.4	23.3	16.3	1.1	0
Kheda	5.7	10.2	28.4	28.4	25.0	2.3	0
Sabarkantha	2.3	18.6	20.9	30.2	26.8	1.2	0
Bharuch	0	11.5	20.7	39.1	24.1	4.6	0
Vadodara	0	8.1	17.2	29.9	37.9	6.9	0
Panchmahal	1.1	4.6	21.6	32.9	35.2	4.6	0
Surat	0	1.1	9.2	13.8	51.7	18.4	5.8
Valsad	0	0	0	5.4	27.0	35.2	32.4
Dang	0	0	4.7	1.2	25.9	32.9	35.3

of Gujarat varied between 350 mm in extreme north-west part of state to more than 2000 mm in the south western part (Fig. 1). The state receives rainfall mainly through the influence of south-west monsoon. About 91 to 97% of annual rainfall is received in four months (June to September) (Table 1). January to May altogether contribute only up to 2.5% to annual rainfall. Among the monsoon months the contribution due to June rainfall is between 9-19% in different districts. It may be seen that the coastal districts receive higher percentage of rainfall (>15%) in the month of June while north Gujarat districts comprising of Kutch, Mehsana, Banaskantha and Sabarkantha receive less rainfall (8-10%). July rainfall contributes about 34-43% to annual rainfall which

is maximum among all the months. western coastal districts receive slightly higher rainfall than other parts of the state in the month of July.

Percentage frequency distribution of rainfall

The frequency of occurrence of low rainfall is maximum (Table 2) in Kutch district. Kutch receives rainfall less than 500 mm in 80% of the years followed by Jamnagar (59%) and Surendranagar (56%). There was not a single year in which these districts had received rainfall more than 1000 mm. The Banaskantha, Mehsana and Ahmedabad districts in north Gujarat and Amreli, Bhavnagar and Rajkot districts in Saurashtra region receive most of the rainfall (more than 60%) in the

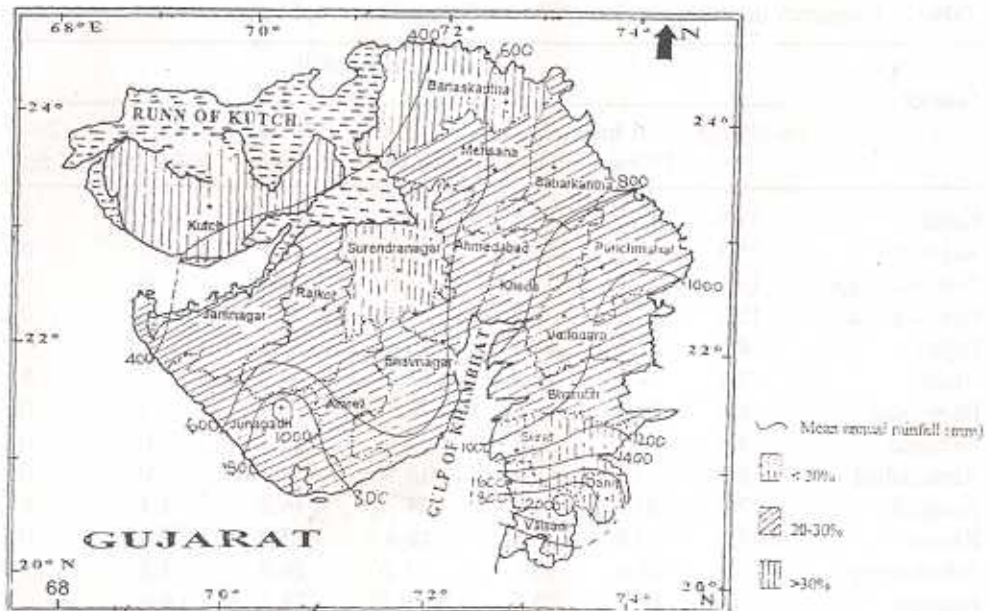


Fig. 2 : Percent chances of occurrence of droughts along with the mean annual rainfall

range of 1750 mm. The heavy rainfall region of Gujarat comprising of Surat, Valsad and Dang districts receives rainfall mostly in the range of 1000-2000 mm.

Occurrence of droughts and floods

Although the occurrence of droughts and floods can not be estimated only on the basis of total annual rainfall as such, nevertheless the information obtained can certainly throw light on their likelihood. The percent chance of occurrence of normal rainfall (Fig. 1) is not directly associated with the high rainfall region, e.g. the districts of Surendranagar and Rajkot being in low rainfall group have higher per cent chances of receiving normal rainfall than many other districts receiving higher rainfall. Banaskantha and Kutch districts have the lowest chance (<40%) of

getting normal rainfall while Surat and Bharuch have maximum (>60%) chances.

Kutch and Banaskantha are prone to experience moderate to severe droughts in more than 30% of the years (Fig. 2). The chances of occurrence of droughts in most of the districts have a wide range from 20 to 230%. Interestingly, Surendranagar, a district of arid region has less chances of experiencing drought.

Unlike to droughts, the floods are associate not only with rainfall received by the district but also the amount of rain received by the districts on the upstream sides. The results revealed that except Ahmedabad and Bharuch districts all have slightly higher chances (>20%) of experiencing floods.

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