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REVIEW OF RESEARCH

RAINFALL REGIME CHARACTERISTICS OF SABARMATI BASIN

Dr. Snehal Nivrutti Kasar
Assistant Professor , Department of Geography,
K.V.N. Naik Art's Commerce & Science College, Nashik,
Maharashtra, India.

ABSTRACT :

Regime of rainfall may be defined as the variations in its widest sense and involves all occurrences. This is portrayed by a graph, based on continues observations of rainfall (Beckinsale, 1969). To recognize the variations in the total amount of rainfall at different stations and to understand the overall pattern of the rainfall, study of rainfall regime is important. The Sabarmati Basin is situated in an environment typical of monsoonal tropics, with periodic high-magnitude rainfall (Kale et al., 1994). The monsoon rainfall is variable, both spatially as well as temporally. The spatial variation in the monsoon rainfall illustrates interplay of meteorology and topography characteristics.

KEY WORDS - *meteorology and topography characteristics , environment typical.*

INTRODUCTION

In addition to this, the geographical location and the east-west orientation of the Sabarmati Basin has also determined the distribution of rainfall in the basin (Abbi and Jain, 1971). Due to orographic effect of the Aravalli hills (the source areas of Sabarmati, Sai, and Wakal Rivers) and Kulali hills and South-west foot hills and Panchera hills (source of the Harnav, Hatmati and Watrak Rivers) 1000 mm rainfall is received. The amount of rainfall exceeds 1000 mm in the lower part of the basin. Seasonal pattern of rainfall is almost similar to its annual distribution, since more than 90 percent of the annual rainfall is recorded during the monsoon season (Abbi and Jain, 1971). Most of the basin receives about 700 to 800 mm rainfall with average annual rainfall of 799 mm.

METHODOLOGY AND RESULTS

The average annual rainfall pattern for fifteen selected rainfall gauging sites in the Sabarmati Basin have been depicted in Fig. 1.2 (a)(b)(c)(d)(e). The average annual rainfall of the source of the Sabarmati River i.e. Nadiad is about 800 mm. The stations located in upstream area have similar annual average rainfall totals. Kheda station situated in the Basin witnesses annual average rainfall of 780 mm. Vijapur station located in middle of the Sabarmati Basin has 760mm of rainfall while Dakor site in the lower Sabarmati Basin has an annual average rainfall of 650 mm. Fig 1.1 shows the gradual decrease in annual average rainfall from upstream site (Nadiad) to downstream site (Dakor).

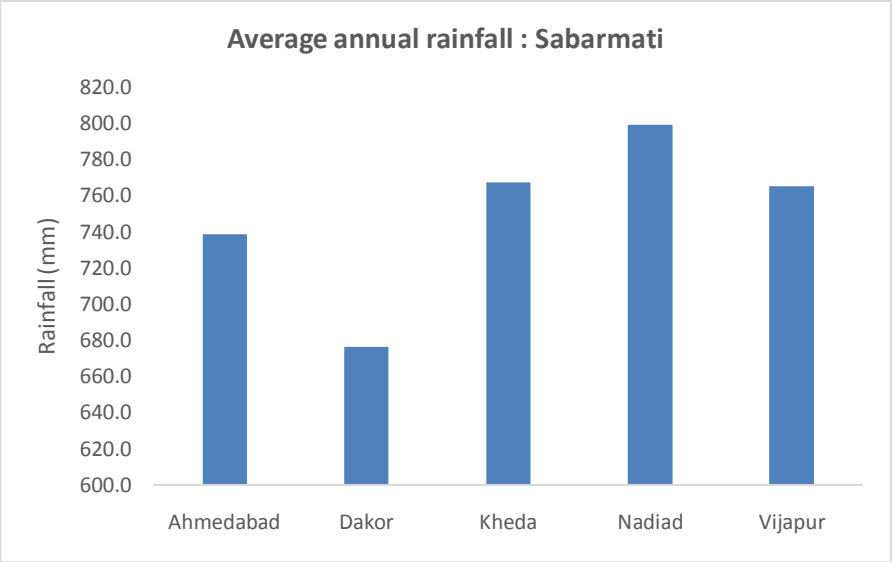

Fig. 1.1

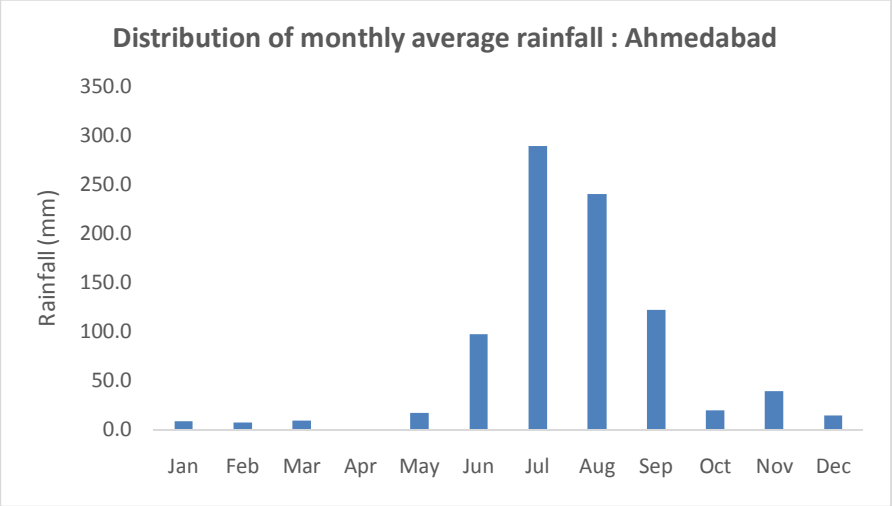

Fig. 1.2 (a)

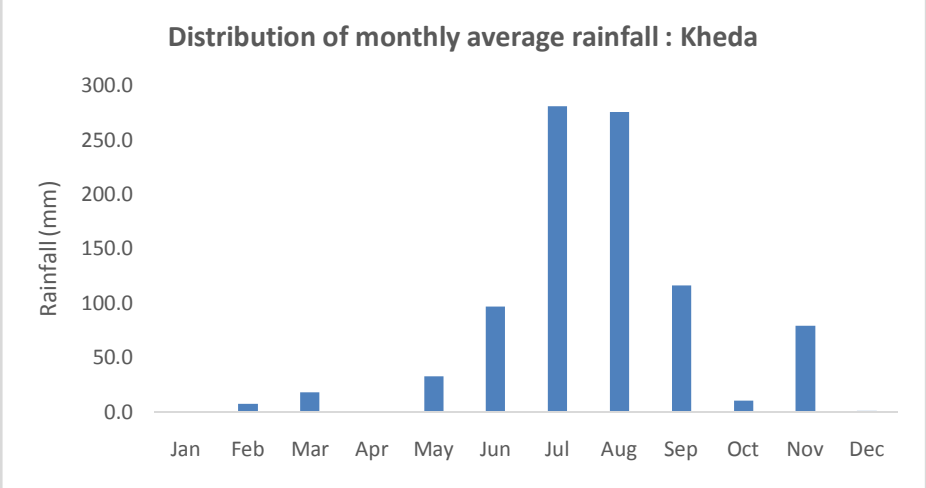

Fig. 1.2 (b)

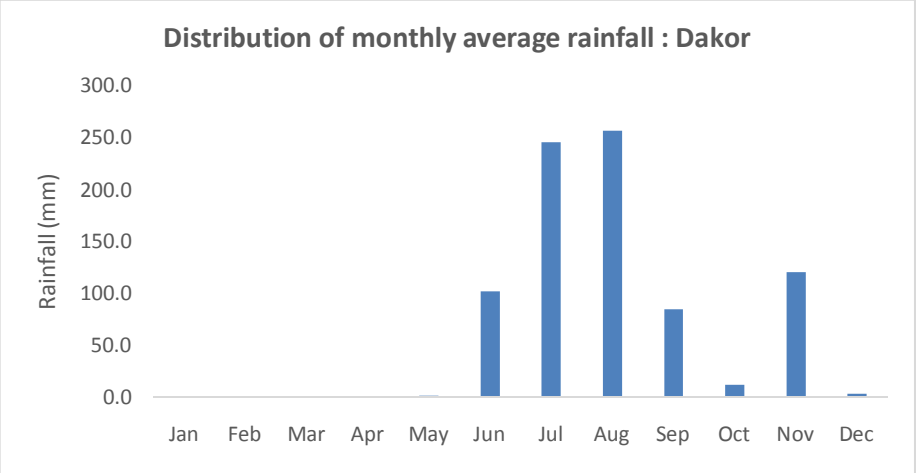

Fig. 1.2 (c)

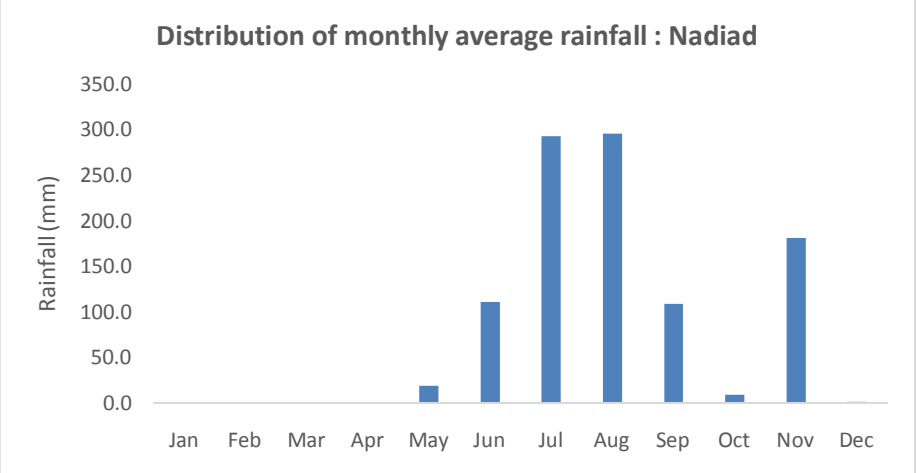

Fig. 1.2 (d)

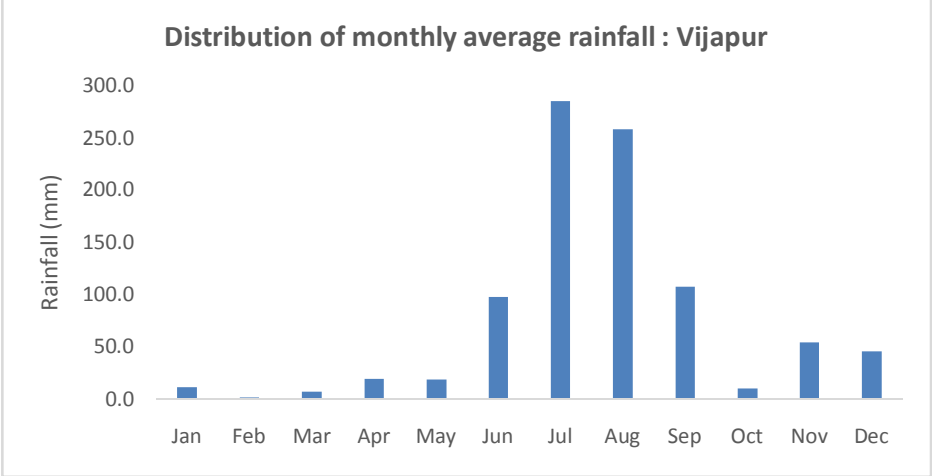

Fig. 1.2 (e)

The maximum annual rainfall in the basin was 2461.5 mm recorded at Modasa in the year 1973. Such a huge amount of rainfall is about 3 times more than the average annual rainfall of the basin (799 mm). The low annual rainfall, less than 615 mm are observed at Kheroj in 1973(Table 4.1). The highest annual rainfalls at different stations show a linkage with their average annual rainfalls. The magnitude of highest annual rainfall at various stations is nearly more than double of the average annual rainfall of the respective station (Table 4.1). Therefore, the possibility of occurrence of floods during such years is high.

A quantitative measure of this variability is coefficient of variations (CV). The CV is a useful measure of variability in the annual rainfall. CV is the ratio between standard deviation and mean. Inter annual variability of the annual rainfall in the Basin is not very highsince coefficient of variations (CV) of annual rainfall in most parts of the Sabarmati Basin is observed around 50. The distribution with less CVimplies more uniformity or consistency andless variability (Dutta, 2006).

Skewness is one of the most commonly used moments for annual rainfall. The values of coefficient of skewness (CSk) are positive for all the stations. They are ranging from 0.83 to 1.96 (Table 1.1). The positive values proposed occurrences of a few very wet years during the gauged period. All the values of the skewness (CSk) are found statistically significant since they are calculated on the basis of more than 50 years data (Viessman et al., 2008).

Table 1.1 Annual rainfall characteristics at selected stations in the Sabarmati Basin

Site	Rmax mm (year)	Rmin mm (year)	AAR mm	σ / SD	CV	CS	KURTOSIS
Dehagam	1474-2003	0	667.4	339.673	50.8929	0.47437	-0.3789
Modasa	2461.5-1973	0	799	396.571	49.6328	1.96522	5.8218
Himatnagar	1653.6-2000	106	7581.6	359.449	47.3851	0.57927	-0.3384
Kheroj	1064-1973	183.5	615	256.932	41.7133	0.18055	-0.482
Volva	1963.9-1984	323	746.9	350.69	46.9549	1.49761	4.09105
Dakor	1438.9-1963	0	676.5	344.388	50.909	0.08379	-0.0073
Dholka	1515-2010	0	676.4	348.455	51.5194	0.79839	0.22704
Derol	1533.8-1973	0	726.8	407.364	56.0467	0.29374	-0.3835
Vijapur	1553-1990	248	765	360.565	47.1327	0.47846	-0.7456
Vijaynagar	1625-2000	91	747.1	326.713	43.7302	0.43728	0.08488
Nadiad	1992-1994	70	798.9	407.142	50.9629	0.85256	1.78873

Sanand	1393.5-1970	0	666.1	307.616	46.1845	0.11526	-0.2373
Malpur	2162.5-2005	299.3	798.2	405.811	50.8378	1.46756	2.4614
Kheda	1904.8-1966	0	767.6	366.966	47.0074	0.72933	1.1647
Kalol	1721.9-1969	118.7	682.3	321.021	47.53	0.91842	1.2684

Data source: IMD; Based on 77-124 years of record; Rmax = Maximum annual rainfall; Rmin = Minimum annual rainfall.

South West Monsoon arrived over North Gujarat around 11th June prior to its normal date. Gujarat as a whole received a rainfall of +5% of long period average, which is considered normal for the region. Monsoon got withdrawn from Gujarat region by 29th September after giving few spells that contributed to the average rainfall over the area.

This year rainfall activity over north region happened mostly due to the intensification of Offshore Trough. This was due to the formation of Mid Tropospheric Cyclone (MTC) over this region. Depressions or low pressure system had no track through this region although 4 depressions and low pressures are formed in Ocean during this monsoon. Anyway remnants of few of the above said pressure systems passed through Rajasthan and neighbourhood as upper air cyclonic circulation.The peripheral effect of these systems contributed a few spells over this region.

2010 average cumulative rainfall of the basin is 789.8 mm. The South-West Monsoon sets in by middle of June and withdraws by the first week of October. In the year 2010 it has received 762.6 mm rainfall.

This year prior to the onset of SW monsoon, the Gujarat state got some rainfall due to the formation and movement of serve cyclonic storm 'Phet' over Arabian sea (2nd to 6th June). Though it does not hit Gujarat the associated circulation of the system brought rainfall over this region. The SW monsoon onset over Kerala took place on 31st may and it arrived over Gujarat around 16th June. Subsequent to this weakening monsoon, the monsoon covered the entire Gujarat only by 7th July.

Like every monsoon, this year monsoon was also unique in its own way. The entire monsoon season was devoid of any monsoon depressions and this was mitigated by the absence of complete break monsoon. Number of rainy days over Gujarat was higherthis year when compared to the last year due to continuous movement of Low Pressure Area (LPA) over this area. One after the other and rest of the days Mid Tropospheric Cyclone (MTC) was active over the region.

Table 1.2: Sabarmati Basin Average Rainfall

Name of Basin → Month ↓	Sabarmati Rainfall (mm)	
	2009	2010
June	16	19.6
July	291	258.7
August	144	352.1
September	11	132.3
October	1	0
Cumulative of season	**463**	**762.6**

The SW Monsoon sets in by the middle of June and withdraws by middle of October. The average rainfall in the Sabarmati basin for past 10 years is 789.8 mm and the rainfall received in 2010 is 762.6 mm. The rainfall data when widespread to heavy rainfall occurred in Sabarmati basin is shown in Table 1.2.

CONCLUSION:

1. The mean annual rainfall of the Sabarmati Basin is 690 mm.
2. The rainfall in the Sabarmati Basin shows the dominance of south west-monsoon season.The basin receives nearly 85 percent of its total rainfall in the monsoon season (June to September) and remaining 15 percent in non monsoon season (October to May).
3. July is the rainiest month which contributes nearly 30 percent of the annual rainfall while April is the driest month in the basin.
4. The rainfall in the basin show variability, although inter annual variability of the rainfall is not too high.
5. Significant variations in different aspects of the rainfall over time and region are found in the basin. The maximum annual rainfall ever recorded in the basin is 2461.5 mm which was recorded at Modasa for the year 1973. Such a huge amount of rainfall is about 3 times more than the average annual rainfall of the basin (690 mm). The least annual rainfall on the record is just 1064mm. This was measured at Kheroj site for the year 1973.
6. Inter annual variability of the annual rainfall in the basin is not very high since coefficient of variation (CV) of annual rainfall in most part of the Sabarmati Basin is observed around 50.
7. The values of coefficient of skewness (CSk) are positive for all the sites. They are ranging between 0.83 and 1.96. The positive values proposed the occurrences of a few very wet years during the gauge period.

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