Research Paper Engineering

Rainfall-Runoff Co-Relationship For Guhai River Basin

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ABSTRACT

Water is a vital natural resource which forms the basis of all life. The finite nature of renewable fresh water makes it a critical natural resource to examine in the context of population growth. Gujarat falls in the sub-tropical climatic zone. Sabarmati is one of the major river of North Gujarat. It is a major west-flowing river and flows for 48 km in Rajasthan before entering Gujarat. The Sabarmati River has five tributaries Hamav, Hathmati, Watrak, Wakal and Sei. Hathmati is one of the major tributary of Sabarmati. Here an attempt has been made to carry out analysis rainfall pattern of Hathmati river basin.

Keywords : Obesity, percentile, breast feeding.

Introduction

The availability of adequate freshwater of appropriate quality has become a limiting factor for the development worldwide. Rainfall is the meteorological phenomenon that has the greatest impact on human activities and the most important environmental factor limiting the development of the semi-arid regions. Understanding rainfall variability is essential to optimally manage the scarce water resources that are under continuous stress due to the increasing water demands, increase in population and the economic development.

This paper carries out analysis of the rainfall by correlating it with runoff for the Guhai catchment.

study area

Gujarat State is situated between 200 06' and 240 42' North Latitudes and 680 10' and 740 28' East Longitudes in the western part of India. It covers a total geographical area of 1,95,984 km2 Out of the total area nearly 1,09,314 km2 is occupied by rocky formations and 86,670 km2 is by alluvium; of which 34,625 km2 is saline area. The State has the longest coastline in the country measuring about 1,600 km along the western part of India.

Sabarmati River originates from the Aravalli hills in Rajasthan. It is a major west- flowing river and flows for 48 km in Rajasthan before entering Gujarat. The total river length is 371 km, of which 323 km is in Gujarat. The river drains into the gulf of Khambhat (Cambay) at Nevido. The total drainage area of Sabarmati River is 21,674 sq. km, of which 81 % is in Gujarat. The Sabarmati River has five tributaries Hamav, Hathmati, Watrak, Wakal and Sei. Wakal and Sei, originates in Rajasthan and the remaining three Harnav, Hathmati and Watrak originates in Gujarat. The basin in Gujarat is largely a plain formed of riverine alluvium and falls under semi-arid region.

CLIMATE OF AREA

The basin falls in the hot semi-arid regions of Western India and experiences hot summer during March to middle of the June. The region experiences three distinct seasons, winter, summer and monsoon. The daily mean annual temperature in the basin is in the range of 250-27.50C. The temperature increases from January onwards and reaches maximum in May and then starts falling. The highest maximum monthly temperature recorded in the basin is 45.90 C in the month of June and the lowest minimum monthly temperature is around 6.30 C in month of December. The maximum mean annual temperature and the minimum mean annual temperature recorded in the basin are 39.60 C and 150 C respectively. South West winds are strong and humid. Due to temperatures and dry weather wind cause high rates of evaporation during summer months.

Table 1: Raingauge stations in study area

Station	Badoli	Balochpur	Khandiol (Guhai Dam)
District	Sabarkantha	Sabarkantha	Sabarkantha
Taluka	Idar	Himatnagar	Himatnagar
Lat	23^{0}49'30"	2339'00"	2343'10"
Long	73^{0}04'20"	73^{0}04'50"	73^{0}02'31"
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Table 2 :Rainfall Data of Badoli Station

YEAR	MONTHLY RAINFALL (mm)					YEARLY
	June	July	Aug.	Sept.	Oct.	RAINFALL
1990	71.8	285.7	392.2	206.7	2.5	958.9
1991	0	467.5	106	20	0	593.5
1992	28	189	132	264.5	0	613.5
1993	44	625	17.5	51.5	0	738
1994	25	389.5	540.5	280	0	1235
1995	6	238	63	76	0	383
1996	30	366	290.5	111	0	797.5
1997	352	152.5	267.5	114.5	21	907.5
1998	62	275	193	285	82	897
1999	97.5	81.5	11.5	39.5	41	271
2000	16	203.5	108	26	0	353.5
2001	23.5	302.5	173	10	0	509

2002	191	6	155	132	0	484
2003	74	347	304	29	0	754
2004	67	91.2	336.5	27	0	521.70
2005	13	367	292	330	0	1002
2006	389	951	186	---	---	1526
2007	33	627	298.2	---	0	958.19
2008	26.5	227	294	---	0	547.5
2009	0	485	306	---	4.8	795.79

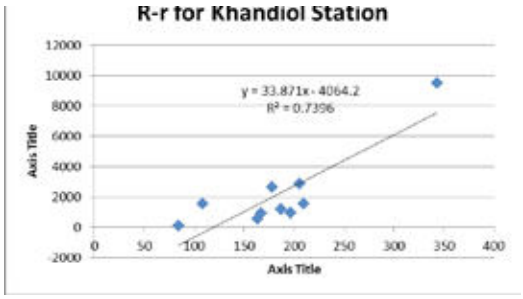
Table 3 :Rainfall Data of Khandiol Station

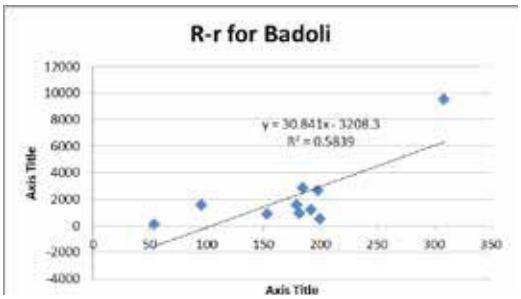
YEAR	MONTHLY RAINFALL (mm)					YEARLY
	June	July	Aug.	Sept.	Oct.	RAINFALL
1990	41	281	369	226	17	934
1991	31	584.5	88.5	7	0	711
1992	16	159.6	162.4	330	0	668
1993	36	691	20	76	0	823
1994	172	346	529	324	0	1371
1995	15	254	101	65	0	435
1996	134	332	263	87	1	817
1997	502	187	218	64	13	984
1998	100	267.1	215	404.3	61	1047.4
1999	123	204.7	14	42.5	38	422.2
2000	31.7	149.2	18	14	0	212.9
2001	50.5	380.4	212.6	0	44.6	688.1
2002	128	28.5	129.3	40	0	325.8
2003	58.8	470.2	271.2	128	0	928.2
2004	123.5	97	252.9	36.8	5.8	516
2005	97.5	357	271.9	212.9	0	939.3
2006	71	418.3	986.9	190.4	0	1666.6
2007	26.5	816.5	284.5	51.5	0	1179
2008	8.1	187.4	390.6	50	0	636.1
2009	12.8	373.1	281.8	53.5	2.5	723.7

Table 4 :Runoff at Badoli and Khandiol Stations

YEAR	RF at Badoli Station	RF at Khandiol Station	Total RF	Average	Q
1990	398.00	186.80	584.80	292.4	1178
1991	663.67	177.75	841.42	420.7083	2625.92
1992	498.00	167.00	665.00	332.5	900.21
1993	498.25	205.75	704.00	352	2856.165
1994	498.50	342.75	841.25	420.625	9517.491
1995	498.75	108.75	607.50	303.75	1559.04
1996	499.00	163.40	662.40	331.2	546.32
1997	399.40	196.80	596.20	298.1	934.616
1998	399.60	209.48	609.08	304.54	1553.8
1999	399.80	84.44	484.24	242.12	108.45

Rainfall-runoff corelationship were established for each station individually as well as for entire basin considering both raingauge station data. The graphical results obtained are as under.





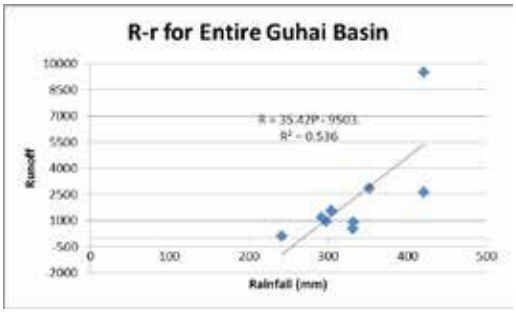


Fig : Rainfall-Runoff Relationship for Guhai Catchment

Results And Conclusion
The corelatioship yield following results :
For Badoli raingauge station
y = 30.84x – 3208.3
R^2 = 0.5839

For Khandiol raingauge station
y = 33.871x – 4064.2
R2 = 0.7396

For entire Guhai Basin
Total Ave. Rainfall = 3297.943 mm
R^2 = 0.536
r = 0.732726

The study area comes under the influence of South-West monsoon. One significant feature of rainfall characteristic of basin is that rainfall is highly erratic. Major part of the total annual precipitation is received during three months July, August and September only. The number of rainy days and maximum daily rainfall also varies in a high range. The distribution of the rainfall over the basin is highly non uniform. The results obtained after analysis reveals that as Coefficient of co-relation value for basin comes out near 1 it is a good co-relationship.

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