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MORPHOMETRIC EVALUATION OF 4TH ORDER DRAINAGE BASIN OF TAPI SYSTEM

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ABSTRACT

Morphometry is the most popular technique of landform evaluation since long in the field of Hydrology, Engineering, Geology and Geomorphology. It includes measurement of linear areal and relief properties of landforms. It has been attempted to used various hypothesis, concepts and determines the landform characteristics. The present paper aims to test the null hypothesis regarding the morphometric characteristics of land form with the help of the quantitative techniques.

Keywords: Basin Area, Bifurcation ratio, length ratio and drainage density.

Introduction

Morphometry is the most popular technique of landform evaluation since long in the field of Hydrology, Engineering, Geology and Geomorphology. It includes measurement of linear areal and relief properties of landforms. It has been attempted to used various hypothesis, concepts and determines the landform characteristics. The present paper aims to test the null hypothesis regarding the morphometric characteristics of land form with the help of the quantitative techniques.

Study Area

The study area is located in the northwest part of Maharashtra, which extend between 73°45' to 74°00' latitude and 21°31'to 21°45' longitude.

Methodology

Six 4th order drainage basins have selected randomly from the given toposheets Nos. 46 G/14, 46 L/13, 46 K/16 of the Tapi river systems .Perimeter ,are, order wise length and number have been estimated. The Basin Area, Bifurcation ratio, length ratio is been calculated for estimation.

Result and Discussions

Bifurcation Ratio (R)

The bifurcation ratio is the ratio between numbers of stream segments of the given order (Nu) and the number of stream segments of next higher order (Nu +1) It can be expressed as

R= Nu / Nu+1

The bifurcation ratio is estimated and tabulated as follow in Table No 1

Table 1

Sample No	Basin No	Order (U)	Number (Nu)	Bifurcation ratio
1	Toposheet Number 46 G / 14	I	166	166/26 = 6.38
		II	26	26 / 09 = 2.88
		III	09	09 / 01 = 9.00
		IV	01	-- --
			202	**Avg 6.08**
2	Toposheet Number 46 L / 13	I	16	16/05 = 3.2
		II	05	05 / 02= 2.5
		III	02	02 / 01 =2.0
		IV	01	-- --
			24	**Avg 2.5**
3	Toposheet Number 46 L / 13	I	42	42/13 = 3.2
		II	13	13 / 07= 1.8
		III	07	07 / 03 =2.3
		IV	03	-- --
			65	**Avg 2.4**
4	Toposheet Number 46 L / 13	I	33	33/ 08 = 4.1
		II	08	08 / 02= 4.0
		III	02	02 / 01 =2.0
		IV	01	-- --
			44	**Avg 3.3**
5	Toposheet Number 46 K / 16	I	76	76/ 21 = 3.61
		II	21	21 / 06= 3.5
		III	06	06 / 01 =6.0
		IV	01	-- --
			104	**Avg 4.37**
6	Toposheet Number 46 K / 16	I	11	11/ 04 = 2.75
		II	04	04 / 02= 02
		III	02	02 / 01 =2.0

		IV	01	-- --
			18	**Avg 2.25**

The table no. indicates that bifurcation ratio is governed by geological structure of the basin and it is more or less constant in regions of similar geological structure .Under the normal circumstances it generally ranges between 3 and 5. The above table reveals that the bifurcation ratio ranges between 2.25 and 6.08 .The range of bifurcation ratio is fairly well beyond the normal range. With this higher variation of bifurcation ratio one can suggest that the bifurcation ratio is controlled by stricter.

Stream Length Ratio

It is the ratio of the average stream length of u + 1^{st} order to average stream length of u th order .It can be expressed as follow

Length Ratio = Lu + 1 / Lu ----------2

Generally the average stream length ratio fairly remain constant in case of lower order stream and fluctuates around 1. It is also governed by geological structure. Average stream length ratio have been estimated with the help of above formula no.2 and tabulated in table no. 2

Table 2

Sample No	Basin No	Order (U)	Length	Average length	Length ratio
1	Toposheet Number 46 G / 14	I	52	0.31	0.30 / 0.31 = 0.96
		II	08	0.30	0.66 / 0.30 = 2.2
		III	06	0.66	1.00 / 0.66 = 1.51
		IV	01	1.00	-- --
					Avg 1.40
2	Toposheet Number 46 L / 13	I	06	0.19	0.50 / 0.19 = 2.63
		II	3.5	0.50	0.50 / 1.00= 2.00
		III	2.0	1.00	1.00 / 1.00 =1.00
		IV	1.0	1.00	-- --
					Avg 1.87
3	Toposheet Number 46 L / 13	I	07	0.18	0.29 / 0.18 = 1.61
		II	3.5	0.29	1.75 / 0.29= 6.03
		III	3.5	1.75	0.5 / 1.75 =0.28
		IV	0.5	0.5	-- --
					Avg 2.64

4	Toposheet Number 46 L / 13	I	04	0.26	0.30/ 0.26 = 1.15
		II	1.5	0.30	2.00 / 0.30= 6.66
		III	04	2.00	1.00 / 2.00 =0.5
		IV	01	1.00	-- --
			44		**Avg 2.62**
5	Toposheet Number 46 K / 16	I	22	0.28	0.64 / 0.28= 2.28
		II	13.5	0.64	0.91 / 0.64= 1.42
		III	5.5	0.91	2.5 / 0.91 = 2.74
		IV	2.5	2.5	-- --
					Avg 2.14
6	Toposheet Number 46 K / 16	I	4.00	0.36	1.60 / 0.36 = 4.40
		II	2.5	1.60	0.75 / 1.60 = 0.46
		III	1.5	0.75	0.5 / 0.75 = 0.66
		IV	0.5	0.50	-- --
					Avg 1.85

The table No.2 revels the following facts

The average stream length ratio ranges in between 1.4 to 2.64. The average stream length ratio of lower order fluctuates around one. The length ratio between IIIrd and IInd order basin varies greatly. The facts shows that the length ratio varies unlike bifurcation ratio.

Drainage Basin Area

The drainage basin area is a total catchment area ,which is the total catchment area of that basin drained by entire network of the same basin. The size of the basin is controlled by lithology, structural topography and climate. The catchment area of 4th order basin has been measured and tabulated in the table No.3

Table 3

Sample Basin	1	2	3	4	5	6
Area (Sq.Miles)	16.87	7.70	3.75	4.50	9.68	2.00
Perimeter (Miles)	18	10	07	09	14	605

The table No.3 shows that the size of the drainage varies greatly .It ranges between 02 to 16.87 Sq.miles though they have same hierarchical order i.e 4th order .The sample No.1 have greatest catchment area in all basins as it is located in the Satpuda region. Topographically it is mountains whereas structurally it is underlined by the cretaceous beds or Bagh beds.Sample No.6 is located in the alluvial plain near the main river Tapi there the relief is faint and structure is alluvial. Thus due to variations in topography and geological

structure it can seen that size of basin is controlled by geological structure and topographic factors.

Reference

1) Clifford. D.Ollier :- The Article for 'Catenas in Different climate' Edited by Carson .M.A. & Kirby- Hill slope from and process. Cambridge University Press (1972) p.p. 138 to167.
2) P.K.Gupta:- Environmental Analysis water ,soil and air published by Agrobios (India) Agro House ,Behind Nasrani cienema chopasani Road ,Jodhpur.
3) Savinder Sigh and A.Dubey(1987) :- Fluvial erosion & sediment load charactertics of Ganga system in U.P. ,India. Geomorphology and Environmental management Allahabad International Symposium.
4) Soil Survey Manual :- U.S. Deptt. of Agriculture (1956)
5) Dr.S.M.Bhamare (1987):- 'Geomorphic Analysis of Panzara Basin " Unpublished Ph.D. Thesis.
6) Dr.M.R.Vaishampayan (2005):- "Palaeo – Hydrological Constraints in River Metamorphosis of Amarawati Basin" Unpublished Ph.D. Thesis.