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Morphometric Analysis of Panzara Basin in Dhule District

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Abstract

The present paper throws light on the morphometric analysis of Panzara river basin. It includes hierarchical order system, bifurcation ratio, storage density of the Panzara basin. Morphometric analysis is refers to quantitative description and analysis of landforms as practiced in geomorphology that may be applied to a particular kind of landform or to drainage basin and large regions generally. Formulas for right circular cones have been fitted to the configurations of alluvial fans, logarithmic spirals have been used to describe certain shapes of beaches and drumlins spoon shaped glacial landforms have been found to accord to the form of lemnicate curve. With regard to drainage basins, many quantitative measures have been developed to describe valley side and channel slopes, relief, area, drainage network type and extent and other variables.

Keywords: Morphometry, Linear Aspect, Relief Aspect, Basin Analysis.

Introduction

The functional relationship among various networks characteristics, including the relationship between discharge on the one hand and drainage area, channel width and length of main stream on other encourage the continued exploration of streamflow in relation to basin geometry. Attention has concentrated especially on peak flows, and since many basins are gaged either poorly or not at all, it would be advantageous to device means of prediction that, while independent of gaging records, are yet accurate enough to be useful.

A general equation for discharge maxima states that peak discharge are power function of drainage area. Such a relationship holds good for maximum discharge of record, but conflicting results have been obtained by empirical studies of stream order, stream length, drainage density, basin size, basin shape, stream and slope aspect and relative and absolute height in relation to individual peak discharge in the shorter term. One reason is that not all these parameters have always been dealt with. In any event, peak discharge is also affected by channel characteristics, vegetation, land use and legs induced by interception, detention, evaporation, infiltration and storage.

Objective of the Study

1. To understand physical environmental profile of the Panzara basin.
2. To attempt morphometric analysis of Panzara basin.

Methodology

The morphometric analysis of Panzara basin on the quantitative methods suggested by Strahler A.N. (1964), Schumm S.A. (1956), Melton M.A. (1958) and Bhamare S.M. (1987). Drainage network map of Panzara basin has been prepared on the basin of toposheet (1:50000). The toposheet No. 46 L/1, 46 K/4, 46H/13 and 46 G/16 have been used for drainage network analysis. Horton's system modified by Strahler has been adopted for hierarchical order system. Order wise stream numbers have been estimation of the morphometric parameters like bifurcation ratio, length ratio etc.

Hierarchical Order System

This is relationship between the number of streams of one order of magnitude in drainage basin and those of the next higher reader. It is often by dividing the numberof the stream in one order by the number in the next highest order, as the ratio is reduced so the risk of folding with in the basin is twice increases. Order which is expressed in terms of following equation-

$$n1/n2= (Rb)$$

$$Rb=Nu/Nu+1$$

Where,

Rb = Bifurcation Ratio
N1= number of first order streams.
N2 = number of second order/ next lower order streams.

Bifurcation Ratio of Panzara Basin

Table No. 1

Stream order (n)	Number of streams	Bifurcation Ratio (Rb)
1	423	3.99
2	106	5.57
3	19	9.5
4	2	2
5	1	-
Mean of bifurcation ratio		5.265

Resource- Computed by researchers.

For the study basin the value of Rb and mean bifurcation ratio are shown in table. It is evident from table that the bifurcation ratio for the basin ranges between 2 and 5.57 mean value of bifurcation ratio is 5.265. the river is fifth order stream and meet near Mudavad in Tapi river.

Bifurcation Ratio of North Basin

Table No. 2

Stream order (n)	Number of streams	Bifurcation Ratio (Rb)
1	228	4
2	57	8.14
3	07	7
4	1	-
Mean of bifurcation ratio		6.31

Resource- Computed by researchers.

In northern basin of Panzara basin total streams are 293. In total streams there are 228 first order streams, 57 second order streams, 7 third order and 1 four order streams are observed. Bifurcation ratio for the basin ranges between 4 and 7. Mean value of bifurcation ratio is 6.31.

Bifurcation Ratio of South Basin

Table No. 3

Stream order (n)	Number of streams	Bifurcation Ratio (Rb)
1	195	3.97
2	49	4.08
3	12	12
4	1	-
Mean of bifurcation ratio		6.68

Resource- Computed by researchers.

In the southern basin of Panzara basin total streams are 257. In total streams are 195 first order streams, 49 second order, 12 third order and 1 four order streams are observed. Bifurcation ratio for the basin ranges between 3.97 to 12. Mean value of bifurcation ratio is 6.31.

With the help of above tables, the ratio of south basin is more than north basin but some variation are seen in different stages of river. Following chart shows comparison between stream order and stream numbers and variation between north basin and south basin with the basin with the help of different stages of river i.e. young stage, middle stage and old stage of Panzarariver.

Drainage Density

Drainage density is defined as the total length of streams of all orders per drainage area. Density factor is related to climate, type of rock, relief, infiltration capacity, vegetation cover, surface roughness has no significant correlation with drainage density. The drainage density indicates the closeness of spacing of channels (Horton 1932). It may be considered as one of the methods of measurement of basin area. According to Horton, drainage Density is defined ratio of total length of all streams in a givendrainage basin to the total area of that basin. It is expressed by a formula,

DD=_L/A

Where,

DD=Drainage Density
_L= Total length
A= Total area

The amount and type of precipitation influence directly to the quantity and characters of surface run-off. An area with high precipitation such as thundershowers loses greater percentage of rainfall in run-off resulting in more surface drainage lines. Amount of vegetation and rainfall absorption capacity of soils, which influences the rate of surface run-off, affects the drainage texture of an area. The similar condition of lithology and geologic structures, semi-arid regions have finer drainage density texture than humid regions. Low drainage density generally results in the area of highly resistant or permeable sub-soil material, sparse vegetation and mountainous relief.

In the study area of Panzara basin total length of streams is 1606.1618 and total catchment area is 1961.9362(sq.km.) drainage density of Panzara is 0.818661585(sq.km.).

Morphometric Parameters InPanzara Basin

Table No. 4

Morphometric Parameters	Symbol/Formula	Result
Area (sq.km.)	A	1961.9362
Drainage density (Km./sq.km.)	DD=_Lu/A	0.818661585
Stream frequency	Fs= Nu/A	0.280845014
Bifurcation ratio	Rb= Nu/Nu+1	5.265
Total streams of Panzara basin		551

Resource- Computed by researchers.
Where,
Lu= Total streams length of all orders.
Nu= Total number of streams of all orders.

Discussion and Result

The present paper is systematic enquiry of morphometric analysis of Panzara basin in Dhule district. It is concluded that the total area of basin is 1961.95 sq.km. Drainage density is 0.81 km/sq.km. and stream frequency is 0.28. The bifurcation ratio of total basin is 5.265. Total length of streams in basin is 1606.16 km. The basin is divided into 5thorder of the stream. The north basin bifurcation ratio is 6.31 and south basin bifurcation ratio is 6.68.

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