A Study of Relief and Slope of Upper Kundalika River Basin, Raigad, Maharashtra.

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ABSTRACT: An attempt has been made for morphometric study of Kundalika river basin. Absolute Relief (AR), Relative Relief (RR), Dissection Index (DI), Average Slope (AS) are the different geomorphic parameters which have been analysed in the study area for morphometric analysis and to prepare the various thematic maps. These parameters have been analysed from SOI topographs. From the morphometric study of the study area, it is found that north-eastern part is hilly (highest elevation 1100 meters).

Keywords: Absolute relief, Average slope, Dissection index, Morphometric study, Relative relief, Vector map.

I. Introduction:
Landforms are the result of geologic and geo-morphologic processes that occur on the earth’s surface [1]. Analysis of morphometric characteristics is a fundamental requirement of landform study of any area. Morphometry is defined as the measurement and mathematical analysis of the configuration of the earth’s surface and of the shape and dimension of its landforms [2]. Morphometric methods though simple, have been applied for the analysis of area-height relationships, determination of erosion surfaces, slopes, relative relief and terrain characteristics as a whole. The morphometric analysis of different regions had been done by various scientists using conventional methods [3],[4],[5]. In the present study morphometric analyses of Kundalika river basin have been carried out with a view to understand the geomorphic characteristics of the study area.

II. Objectives of the Study:
The main objectives of this paper are to –
1. Draw the contour map of Kundalika river watershed and find out the average slope
2. To find out the absolute relief and relative relief.
3. Study dissection index.

III. Study Area:
The Upper Kundalika is a small river flowing from the Hills of Sahyadri to the Arabian Sea. The distance of the Upper Kundalika basin is 42.5 km and total area covered by this
watershed is 356.74 sq km. This river originates to the West of at small town called Bhira in the Indian State of Maharashtra, 150 km south east of Bombay (Mumbai). It is about seventy kilometers from Panvel.

The latitudinal extent of the study area of Upper Kundalika basin is 18°20’ North to 18°35’North and longitudinal extent is 73°40’ East to 73°11’ East. This area covered in the SOI toposheet no 47F/3, 47F/6 and 47F/7. The Upper Kundalika maintains fairly straight course in E-W direction up to Roha and then follows as SE-NW trend.

![Location Map of Upper Kundalika River Basin](image)

**Fig no : 01**

**IV. Database and Methodology:**

For the preparation of base map and for morphometric analysis of the study area, topographical sheets of 1:50,000 scale of the Survey of India are used. Absolute Relief (AR), Relative Relief (RR), Dissection Index (DI), Average Slope (AS) are the different geomorphic parameters which have been analysed in the study area to differentiate physiographic characteristics and to prepare the various thematic maps. For the purpose of relative relief analysis, the height difference between the highest and lowest elevation within each grid is computed with a contour interval of 20m. The dissection index, which is the ratio between
relative relief and absolute relief, gives a better understanding of the landscape. Nir [6] computed ‘Dissection Index’ as the ratio of two morphometric variables i.e., relative relief and absolute relief within a specific areal unit.

Fig no : 02

Fig no : 03
V. Results and Discussion:

AVERAGE SLOPE:

Slopes, defined as angular inclinations of terrain between hill-tops and valley bottoms, resulting from the combination of many causative factors like geological structure, absolute and relative reliefs, climate, vegetation cover, drainage texture and frequency, dissection index etc. are significant morphometric attributes in the study of landforms of a drainage basin. Computation of slope angles from topographical maps or through field measurement involves tedious and time consuming procedures. Several techniques of deviation and computation of average slopes from topographical maps have been suggested from time to time but the techniques of Wentworth being easier and involving lesser measurement and calculation and more rapid procedure than other schemes has been widely used by several geomorphologists. The values of slope angles derived for each grid square of the drainage basin are tabulated and classified into convinent slope categories.

i) Level slope category = 0°-2°
ii) Gentle slope category = 2°-5°
iii) Moderate slope category = 5°-15°
iv) Steep slope category = 15°-30°
v) Very steep slope category = above 30°.

Above DEM model made with the help of Arc GIS 10.2.2 Software which is used slope analysis. In that map of slope indexing shown various colour combination green colour indicate slope is 0°-5° mostly this area is more intensive in the study area. Third group which is shown in yellow colour in the above map which slope angle is 15°-21° this slope is found SW, NW, SE, and East the upper part of the Upper Kundalika river basin. Next two slope group is very less in that catchment area which is found at N, SW, NE, E, and SE the slope angle is 35°-75° respectively.

AT the NE side at Sudhagad the elevation is 358.44 m to 542.54 m. Along the side of Bhira maximum height is 693.11 m at 18° 28’ N and 73° 24’. There are two subsequent streams one is at NE side near by Sudhagad and another is at Bhira. these two streams confluence found near by Kamat at 18° 27’ N and 73° 16’ E where 238 feet height. At the North of Vardayini elevation is 177.69 to 202.08 m. At the North of catchment near by Medhe the elevation is 203.91 m. At the south of Roha elevation is 12.19 m to 21.94 m near Kolad elevation is 72.84 m . Huge Sahyadri is a highest part in South.
Fig no : 04

Fig no: 05
ABSOLUTE RELIEF :-

Absolute relief contains maximum height in the topography. Absolute map indicate maximum and minimum height in the areas. The Upper Kundalika Watershed contains maximum 957.68 m and minimum 12.19 m. Above map indicates that Roha, Neve, Chile, Gondal, Pipoli, Fanaswadi, Godalwadi, Kolad and Peet Khurdh contains 50m elevating villages. At the North of Chile and South of Puale Khurdh their elevation is more than 300m at North and more than 200m at South. Maximum elevation which is indicating in blue colour, there is 1100m elevation. Along the North of Potlaj the elevation is 500m respectively. The Maximum and minimum relief found at NE to SE near by source of the river and valley bottom of river which is 91.44 m to 3.96 m means at Bhira 91.44 m and Roha 3.96 m respectively.

RELATIVE RELIEF :-

Relative relief also termed as amplitude of available relief or local relief, is defined as the difference in height between the highest and lowest points in a unit area, it may be grid square, rectangle or a minute –grid square. Relative relief is a very important morphometric variable which is used for the overall assessment of morphological characteristics of terrain and degree of dissection. W.S. Glock (1932) used the amplitude of relief and defined it as the
vertical distance from a horizontal fairly flat upland down to the initial grade of streams. M.A. Melton (1957) suggested to calculate relative relief by dividing the difference of height between the highest and lowest point in the basin with basin perimeter. Where as J.C. Maxwell (1960) calculated relative relief on the basis grid square calculation on the basis of highest and lowest elevations and the data of relative relief so derived are tabulated and classified into six categories viz.

i) Extremely low relative relief= 0m-15m
ii) Moderately low relative relief= 15m-30m
iii) Low relative relief= 30m-60m
iv) Moderately relative relief= 60m-120m
v) Moderately high relative relief= 120m-240m
vi) High relative relief= above 240m.

At North Ashtami to Devkhania extremely low relative relief, North of Yeral there is moderately relative relief. At NE contains high relative relief which is more than 300m respectively. At mid near by river Roha to Kolad there is found 0m–15m relative relief Kolad to Kamat have 15m-30m relative relief and Kamat to Bhira low relative relief which is 30m-60m respectively. At South Tala to Hetavane, Hetavane to Tortavali, Tortavali to Mangaon there is extremely low relative relief. At the E of Mangaon there is high relative relief which is more than 40m.
DISSECTION INDEX:

Dissection index, expressing a ratio of the maximum relative relief to the maximum absolute relief, is an important morphometric indicator of the nature and magnitude of dissection of terrain. Slaucitajs (1936) used real area and projected area between successive contours to calculate dissection index between different height groups as follows.

i) Extremely low dissection index = 0-0.1
ii) low dissection index = 0.1-0.2
iii) Moderately dissection index = 0.2-0.3
iv) High dissection index= 0.3-0.4
v) Very high dissection index = More than 0.2

High Dissection is found at North of Ashtami 0.35, North of Bhane 0.4, N of Chile 0.4. At NE very high dissected area which is near by more than 0.8. This is found N of Bhira. At mid area near Ghaatav dissection index is 0.3, low dissection near by Roha, North of Yeral dissection index is 0.2-0.3. At south of Tala dissection index is 0.3 south of killa more than 0.45, Near Bhuliwan more than 0.45, South of Gulawadi dissection index is more than 0.4, and SE the catchment dissection index is more than 0.8 respectively.

VECTOR MAP OF THE KUNDALIKA RIVER BASIN:
In the above vector map of Upper Kundalika river at the north east region the top of the mountain and valley bottom the slope are very steep and this slope is inclined southward and northeast direction. At the north side of Patnus,Potlaj,Chile,Bhane and Ashtami there are steep slopes and these slope inclined northward direction. At the south of Upper Kundalika river watershed at the west of Ghatad there slope inclined west,southwest,and east directions. Near by Warsgaon slope inclined southward direction.

V. Conclusion:

The basin relief (H) 1336.3m and relief ratio (R) is 0.031m ie at source region there are high elevation and at mid stage river sudden flow on the plain surface.

In the slope analysis of Upper Kundalika river basin areas slope varies at NE 20% , at SE 20% there are very steep slopes. At the North of watershead there are moderate slope the percentage of moderate slope is 10% and at south there are also moderate slope there is 8% in the absolute relief covers 25% at NE this is very high relative relief. Dissection index varies 0 to 0.45 in the kundalika river watershed.

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References:


