

SYNOPSIS

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Name of Guide :	Prof. S.K.Patil
Proposed Title :	“Morphometric Analysis for Geo-Hydrological Studies Using Geo-Spatial Technology - A Case Study of Panchganga River Basin, Maharashtra, India

1) Introduction

One of the most concerning issues currently being faced by the society is the increase in world's population and its impact on the availability of freshwater. Presently high in habitant's expansion, fast urbanization and climate change along with the irregular frequency and intensity of rainfall make difficulty for appropriate water management and storage plans. Therefore, there is an urgent need for the evaluation of water resources because they play a primary role in the sustainability of livelihood and regional economics throughout the world (Singh et al. 2011, 2013).

The drainage morphometric analysis are prerequisite for selection of water recharge site, watershed mode ling, run-off modelling, watershed delineation, groundwater prospect mapping and geotechnical investigation (Magesh et al. 2011; Thomas et al. 2012).

Morphology is the science of origin and evolution of topographic features or attributes caused by physical and chemical processes operating at or near the earth surface.

Geomorphology determines the variation in earth's surface from past to present and its causative factors. Whereas, the term Morphology is a science and measurement of forms or structures which is quantitative determination of landform

Morphometry is the measurement and mathematical analysis of the configuration of the earth's surface, shape and dimension of its landforms (Agarwal, 1998).

Morphometric analysis is the numerical assessment of a basin altitude, volume, slope, profiles of a land as well as drainage basin characteristics of an area in question (Clarke 1966; Singh 1972 Strahler 1964)

Quantitative morphometric analysis of watershed can provide information about the hydrological nature of the rocks exposed within the watershed. A drainage map of basin provides a reliable index of permeability of rocks and their relationship between rock type, structures and their hydrological status. Watershed characterization and management require detailed information for topography, drainage network, water divide, channel length,

geomorphologic and geological setup of the area for proper watershed management and implementation plan for water conservation measures (Sreedevi et al. 2013).

Morphometric analysis for evaluation of drainage basin, their characterization and classification has been performed from the early nineties by the pioneer workers for linear, aerial and relief aspect and interpretation of their interrelationship with reference to land and water management.

(Horton 1945; Smith 1950; Strahler 1957). Further advancement in computer-based technology pre-cise work has been accomplished using advanced techniques like geographical information system and related tools for automated determination of the basin parameters, which results in time-efficient, accurate and reliable results (Grohmann 2004; Gangalakunta 2004; Grohmann et al.2007; Hlaing et al. 2008; Javed et al. 2009).

Remote sensing and GIS techniques are now a day used for assessing various terrain and morphometric parameters of the drainage basins and watersheds, as they provide a flexible environment and a powerful tool for the manipulation and analysis of spatial information. In recent years, application of satellite data and Geographical Information System (GIS) tools have been successfully explored to generate adequate data on the spatial variations in drainage characteristics which provide an insight into hydrologic conditions, hence for the watershed management (Das and Mukherjee, 2005; Vittala et al., 2004)

GIS techniques are found relevant for the extraction of river basin and its drainage networks. It therefore needs to analyse high level parameters of drainage and environment for suitable planning and management of water resource developmental plan and land resource development plan. GIS based on analysis of all morphometric parameters and the erosional development of the area by the streams has been progressed well beyond maturity and lithology is an influence in the drainage development. These studies are very useful for planning of rain-water harvesting and watershed management

2) Relevance

The Panchganga River basin is a chronically drought prone area. The economy of this area mainly depends on agriculture. Agriculture depends on groundwater/subsurface water because surface water sources are scarce. Due to vagaries of monsoon rainfall and uncontrolled withdrawal of subsurface water the water levels have declined to deeper levels. As a consequence, the Geo-Hydrological Studies are mandatory for developing surface and subsurface water resources of this area. For preparing a proper watershed development plan, it becomes necessary to understand about the geological and geomorphological factors, which affect the occurrence and movement of surface and subsurface water of this region. The morphometric analysis of the drainage basin and channel network play an important role in understanding the geo-hydrological behavior of drainage basin and expresses the prevailing climate, geology, geomorphology, structural antecedents of the catchment. The drainage basin analysis is important in any hydrological investigation as assessment of groundwater potential, groundwater management, pedology and environmental assessment. Hydrologists and geomorphologists have recognized that certain relations are almost important between runoff characteristics, and geographic and geomorphic characteristics of drainage basin

systems. In the present study an attempt will be made for morphometric analysis for Geo-Hydrological Studies necessary to understand about the geological and geomorphological factors, which affect on the occurrence and movement of surface and subsurface water of this region. Geographical Information System (GIS) techniques are now-a-days in use for assessing various terrain and morphometric parameters of the drainage basins and watersheds, as it provides a flexible environment and an important tool for the manipulation and analysis of spatial information

3) Literature Review

3.1. Dr. Amba Shetty, Kumar Raju, (2010), “Morphometric Analysis Of Netravathi River Basin Using GIS Techniques”

In this paper morphometry characteristics of Nethravathi River basin was evaluated by using GIS. It is concluded that geologic structure of the river has a dominant influence on the drainage pattern. Also, The GIS methodology used in this study provides not only a rapid analysis of spatial data of a large river basin but also an objective approach with consistent measurement and calculation processes in which human errors were eliminated.

3.2. Tejaswini N. Bhagwat a, Amba Shetty b, V.S. Hegde, (2011), “Spatial Variation In Drainage Characteristics And Geomorphic Instantaneous Unit Hydrograph (GIUH); Implications For Watershed Management—a Case Study Of The Varada River Basin, Northern Karnataka”

In the absence of hydrologic data geomorphologic instantaneous unit hydrograph (GIUH) plays a vital role and used in broad scale for planning of watershed management programs. The Fifth order basins from different agro-climatic zones in the Varada River basin was selected to understand the spatial variation in drainage characteristics. Fifth order sub-basin has potential for artificial recharge programs in the Southern Region and in Northern Region where hilly non-forest zone is ideal for surface water storage.

3.3. Dr Kuldeep Pareta and Upasana Pareta, (2011), “Hydro-Morphogeological Study Of Karawan Watershed Using Gis And Remote Sensing Techniques”

The hydro-morphogeology branch is recently developing branch which is combination of hydrology, geomorphology, and geology. In this paper the author evaluated the groundwater perspective zones and different Hydromorphogeological units have been discovered by using image interpretation. By using Remote sensing Techniques he identified the potential zones of the Karawan watershed for development planning and by that study he concluded the prediction limitations and their implementation with reasonable accuracy of GIS is more as compared to the manual recognition.

3.4. Dr Kuldeep Pareta a, Upasana Pareta b, (2012), “Quantitative Geomorphological Analysis Of a Watershed Of Ravi River Basin”

Morphometric analysis for watershed provides drainage system description, which is important for characterization of watershed. The morphometric analysis of the channel which shows that the rainwater drain towards a reference point of the watershed shows a tree-like pattern. The bifurcation ratio in the watershed indicates normal watershed category and the presence of moderate drainage density

3.5. Chougale Sujit and Sapkale Jagdish, (2017) “Morphometric Investigation Of Morna River Basin, Maharashtra, India Using Geospatial Techniques”

Watershed management and sustainable development of the river basins are the priorities in the present time morphometric analysis helps to regulate and understand the hydrological characteristics of river basin and their results will be a necessary input for an absolute water resource management and plan. Current research has proved that geo-spatial techniques like GIS and Remote sensing are very efficient techniques for analysis and evolution of morphometric parameters of river basin, Terrain parameters are studied with GIS and Satellite Data are used for better understanding of landforms which are helpful for water management planning, natural resource management, plantation and understanding physiography of basin.

3.6. Jabir Haruna , Biswajeet Pradhan, (2018), “Quantification Of Runoff as Influenced By Morphometric Characteristics In a Rural Complex Catchment”

The study of watershed was delineated into four major catchments in Kelantan River basin. After studying the quantification of runoff, it was found that geomorphological studies are essential for understanding the rainfall–runoff response of a watershed as well as for prediction of flood peaks in conjunction with hydrological models.

3.7. Snehakumari S. Parmar, (2019), “Morphometry Analysis Using Saga GIS : A Case Study Of Watershed - 63 Of Narmada river, Gujarat, India”.

The integral use of remote sensing data and GIS technique becomes helpful to find out the area which is affected by the sedimentation process. In this present paper it is concluded that the watershed of narmada river have moderately high severe soil erosion effect which will ultimately affect the life of dam.

4) Proposed Work

a) Objectives

The basic aim of this study is to perform morphometric analysis and study Geo-Hydrological Studies Using Geo-Spatial Technology. To fulfil this basic objective, the following specific objectives are defined:

- (i) To extract and analyse the linear, aerial and relief morphometric attributes of Panchganga River basin using geo-spatial technology from DEM using Geo-Spatial Technology.
- (ii) To assess quantitative basin Potential of Panchganga River basin
- (iii) To prioritize sub-watersheds primarily for groundwater potential and conservation structures for selected sub-basins of Panchganga River basin.

b) Methodology

Proposed work will be achieved by considering following methodology:

1. Generation of georeferenced topographic maps with the help of toposheets of Survey of India of scale of 1:50000 in QGIS software 3.16.
2. Development of Digital Elevation Model (DEM) for Panchganga River Basin by using Shuttle Radar Topography Mission (SRTM 30 m) data.
3. Delineation of Panchganga River basin by using both toposheets and DEM.
4. Extraction and quantification of morphometric parameters of Panchganga River basin for morphometric analysis to perform Geo-Hydrological Studies
5. Assessment of quantitative basin Potential of Panchganga River basin
6. Prioritization of sub-watersheds primarily for groundwater potential and conservation structures for selected sub-basins of Panchganga River basin based on Geo-Hydrological Studies.

c) Expected Outcomes

The outcome of this study would help the hydrologist, geomorphologists, developers, engineers, to use the morphometric technique vis-a-vis GIS to give an insight of the different geo-hydrological characteristics of the drainage basin to help in the identification of groundwater potential zones and overall management of the basin with focus on groundwater. It is expected that, present study would also assist in the adoption of better watershed management practices to overcome issues of drought, flood, excessive runoff, poor infiltration, soil erosion, human health, and low productive yield.

d) Facilities Available

1. Central College Library
2. Departmental Computer Laboratory.

Guide**Student**

(Signature of guide)

Prof.S.K.Patil.

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5. Jabir Haruna , Biswajeet Pradhan, 2018 Quantification Of Runoff As Influenced BY Morphometric Characteristics IN A Rural Complex Catchment
6. Snehakumari S. Parmar, 2019 Morphometry Analysis Using Saga GIS : A Case StudY Of watershed - 63 OF Narmada River, Gujarat, India.
7. Tejaswini N. Bhagwat , Amba Shetty , V.S. Hegde, 2011 Spatial Variation In Drainage Characteristics And Geomorphic Instantaneous Unit Hydrograph (GIUH); Implications For Watershed Management—A Case Study Of The Varada River Basin, Northern Karnataka
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