



GIS Based Automated Drainage Extraction for the Analysis of basin Morphometry in Vaniyar Sub-basin, South India

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Abstract: In this paper, the Automated Extraction of Drainage through the SRTM data to delineate the basin morphometry using Arc GIS technique is attempted. This automated extraction tool will create the possible drainage pattern in the study area. After extracting the drainage, this was used to analyze the morphometric parameters such as, stream network (Strahler's), and basin boundary. This technique is very useful for those who work in the field of terrain analysis, hydrology, and watershed analysis as it is easy to use with a single click for the generation of a reliable database for morphometric analysis.

Keywords: Morphometry GIS, SRTM, Drainage, hydrology

I. Introduction

The analysis of drainage basin is one of the most important parameters for the water resource studies as it provides valuable information concerning the quantitative explanation of the drainage system. This quantitative analysis is an important aspect of the characterization of a basin [12]. Morphometric analysis requires the measurement of linear features, areal aspects, gradient of channel network and contributing ground slopes of the drainage basin [10]. Drainage characteristics of many river basins and sub basins around the globe have been studied using conventional methods [4, 11, 12, 7 & 6]. Traditional methods such as field observation and topographic maps are commonly used for the identification of drainage networks in a basin. Alternatively, advanced methods like remote sensing and feature extraction from digital elevation models are also opted [13, 9, 8 & 5]. Analysis of all drainage networks from field observation is a tedious task because of the vast extent of rough terrain.

Hence, the DEMs can be used to extract the drainage networks with the help of GIS techniques [3]. This template provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example.. Some components, such as multi-leveled equations and graphics, are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

An automated extraction model is developed in this study that can be used to extract the drainage networks with the help of SRTM data through the use of ArcGIS software. The hydrology tool SRTM data is used as the input parameter for basin delineation and other supporting data for morphometric analysis. The developed tool was applied to Vaniyar River basin for data validation, and it was found that the data thus generated are reliable for further morphometric analysis.

II. Study Area

The Vaniyar Sub-basin of Ponnaiyar River, Tamilnadu, has been selected for the present study. The study area, lies between the latitudes 11°46' N to 12°09'39" N and longitudes 78°12'27" E to 78°36'65" E covering an area of 982.25 km². out of which plain land covers an area of 591.43 km² (Figure 1). The study area falls in Salem and Dharmapuri districts of Tamil Nadu. The base map was prepared from toposheets nos. 57L/4, 8, 58, I/1, and 5 of 1:50,000 Scale. The ephemeral stream Vaniyar has its source along the northern slopes of Shervorayan hills and originating at Kombur and takes a course along the northeast in the valley and emerges out as the main artery of Dharmapuri district with northeast gradient and small portion of catchment area falls in Salem district.

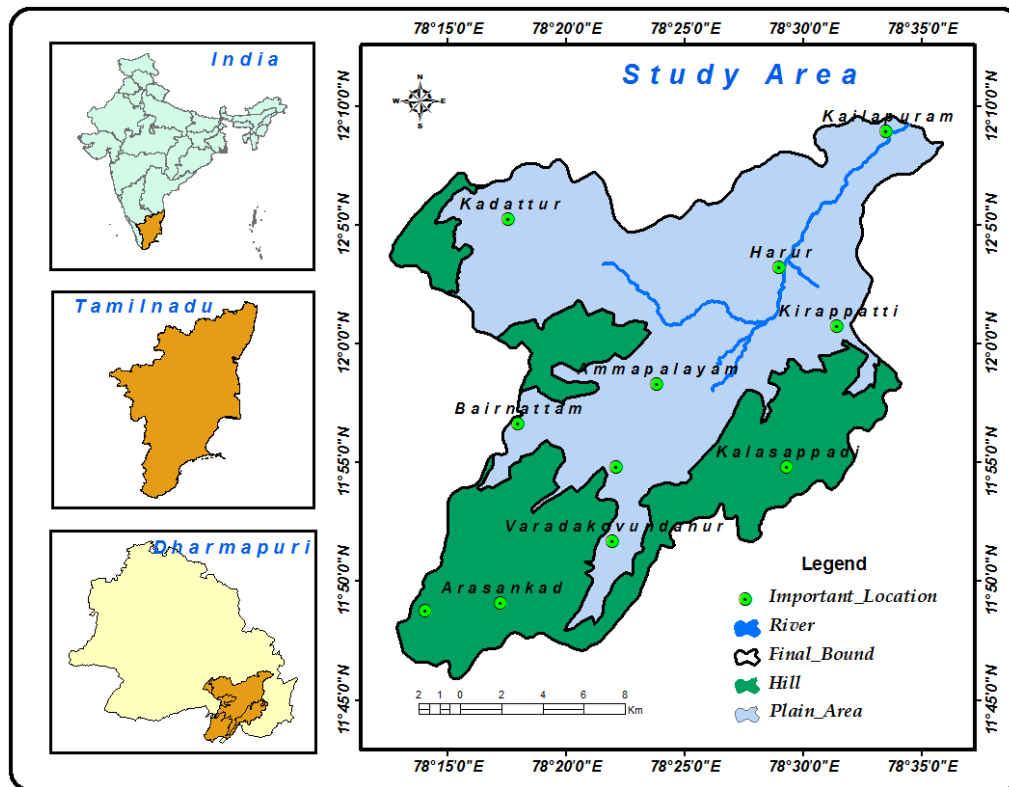
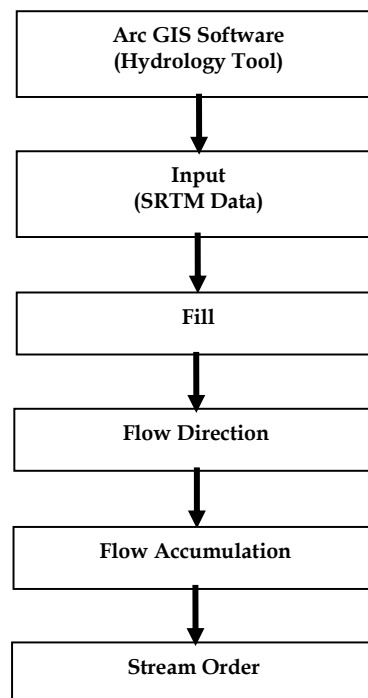


Figure 1: Location map of the Study area.

III. Methodology

Figure 2: Flow chart showing methodology.



IV. Result and Discussion

In the present study effectively exploring the hydrology tool; describe the process extraction of basin morphometry. The hydrologic tools allow you to identify sinks, determine flow direction, calculate flow accumulation, delineated watersheds, and create stream networks. Using a digital elevation model (DEM) as input, it is possible to automatic delineated a drainage system and quantify the characteristics of the system. The following graphics illustrate the steps involved in calculating a stream network from a DEM.

A. Fill

The hydrology function tools in ArcGIS any basins in the original DEM are identified. A sink is usually an incorrect value lower than the values of its surroundings. The depressions shown in the graphic above (the scattered colored points) are problematic because any water that flows into them cannot flow out. In order to ensure proper drainage mapping, these depressions can be filled using the Fill tool (Figure 3).

B. Flow Direction

Using the DEM as input into the Flow Direction tool, the direction in which water would flow out of each cell is determined (Figure 4).

C. Flow Accumulation

To create a stream network, the Flow Accumulation tool is used to calculate the number of upslope cells flowing to a location. The output of the Flow Direction tool from above is used as input (Figure 5).

D. Stream Order

A threshold can be specified on the raster derived from the Flow Accumulation tool; the initial stage is defining the stream network system. This task can be accomplished with the Con tool or using Map Algebra. An example of Con is a new raster = con (accum > 100, 1). All cells with more than 100 cells flowing into them will be part of the stream network. Apply the Stream Order tool to represent the order of each of the segments in a network. The available methods for ordering are the Strahler techniques. In the study area, 1st order, 2nd order, 3rd order, 4th order and 5th order streams are present in Vaniyar basin (Figure. 6).

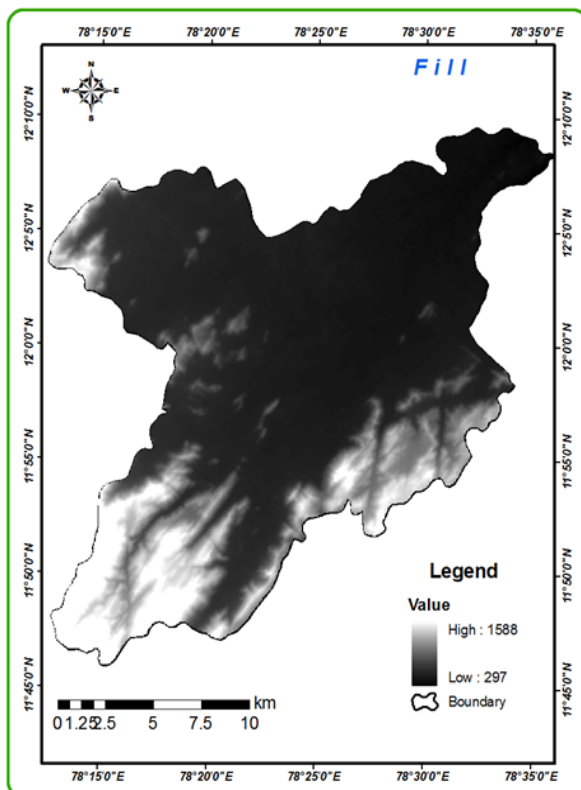


Fig.3. Fill map of the study area.

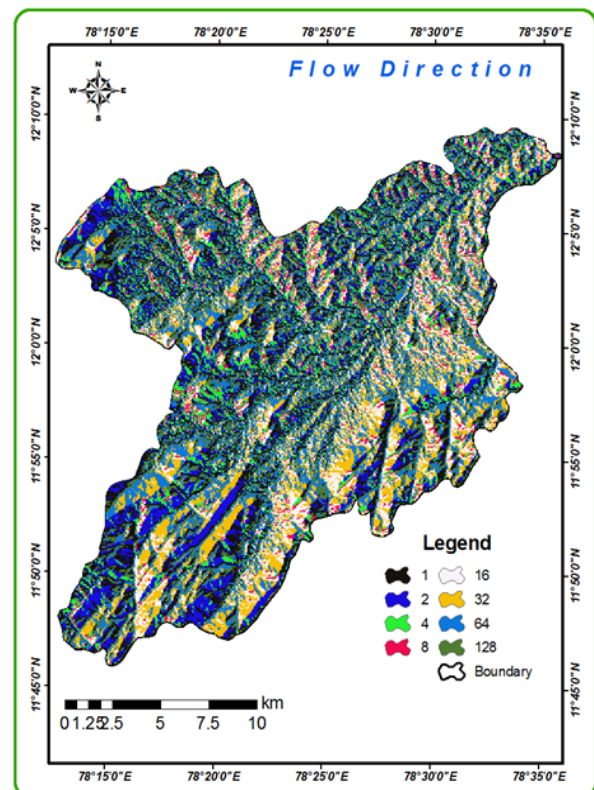


Fig.4. Flow Direction map

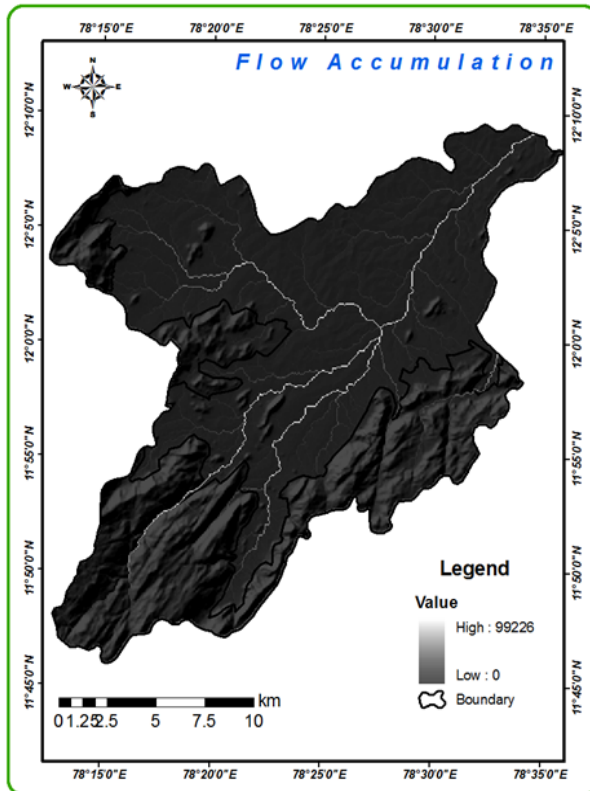


Fig.5. Flow Accumulation map.

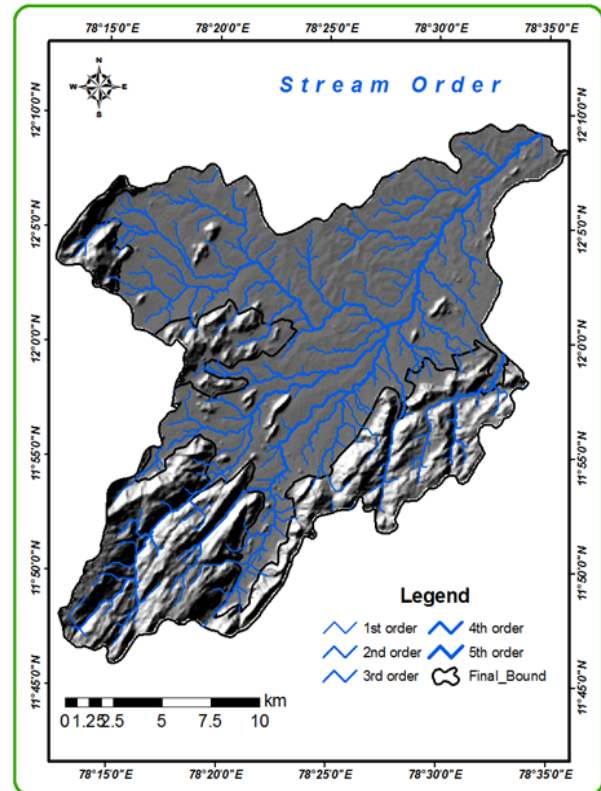


Fig.6. Stream Order map.

V. Conclusion

In this paper, an attempt has been made to study the extraction of automated drainage network and its analysis using SRTM data as input. The detailed drainage information is extracted through Hydrology tool in ArcGIS. The 1st, 2nd, 3rd, 4th and 5th orders of the stream in Vaniyar river basin are covered in the present study. It is easy to make the result with a single click for the generation of a reliable database for morphometric analysis. This technique is very useful for those who work in the field of terrain analysis, hydrology, and watershed analysis.

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