Study On Flood Management and Analysis Using Geographical Information Systems On Godavari, Konaseema District, India.

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Abstract. The Konaseema area in Andhra Pradesh, India is prone to flooding due to coastal storms, storm surges, and river overflows. Flooding can be dangerous and pose a threat to human life and property. Floods are unpredictable and can happen suddenly, causing significant damage. Therefore, planning for flood management is essential for rescuing flood victims, resolving flood issues, and implementing preventive measures. In recent years, flooding has become more frequent in the Konaseema area, especially in the Godavari river's and near surrounding areas. Heavy floods from the Godavari River have been caused severe flooding in nearby konaseema villages. Flood management by water resource planners using GIS (Geographic Information System) developed land use and land cover maps, Flood zone maps in the study region. This study aims to analyse impact of Godavari River floods in Konaseema and East Godavari district Andhra Pradesh, India. DEM (Digital Elevation Model) is generated and prepared various thematic maps of Flood prone regions. The GIS generated flood impacted maps are analyzed and these maps will help to rescue the people from flood regions and migrate them in time to the safe zones.

Key words: Floods, GIS, Konaseema, Godavari, DEM (Digital Elevation model), Godavari District.

1 Introduction

River Godavari in the Konaseema area exists in the lower Godavari basin. The main villages are Kunavaram which has a drainage area of 284880sq.km, Dhavaleshwaram contain 311150 sq. Km, Rajahmundry covered a drainage area of 310610sq.km. A.P CWC report (2014 ) The Konaseema is very frequently affected by floods once every couple of years. The drainage area of Godavari district is The management and transportation of water essential to human civilisation. Hydraulic structures are still required as infrastructure

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ages and development continues the increased attention to dam safety. The revised and increased predicted maximum flood flows have led to the discovery that many rivers need to be repaired [1]. The practical hydraulic construction for a variety of uses is the weir (e.g., canals, ponds, rivers, reservoirs, and others). A form of weir is frequently used as the flow control structure in existing spillways. Floods are the most frequent type of natural hazard that is caused due to heavy rains and the melting of snow and ice in the cold countries, floods are caused due to intense human activities and changes on the earth surface [2]. Floods are impact on human life by Damage the property, destruction of crops and increase the water-born diseases. Geographic information systems is one of the most effective flood management strategy (GIS)[3]. To develop flood damage estimation, GIS maps and flood risk maps is perfectly to utilised and depict the area of flooding and the flood impacted region. Floods are very frequent events in the Konaseema district due to Godavari River, Andhra Pradesh(A.p), India. By using the GIS, preventive measures are given to rescue the flood-affected people to migrate[4]. In this paper flood impacted areas are analysed in study area. The highest rainfall in East Godavari is observed 257mm.in the year 19june1996,389mm in 10 May1990 and 11 May1990, 447 mm in 9 May1990. Recently heavy rainfall events occurred in the konaseema (lower Godavari basin) on 14 July 2023 cause a huge flood in the konaseema and near villages. This study aims to analyse the flood impacted areas and after that providing various technical conclusions.

2 Material and Methods

GIS software version 10.1 was used to conduct a flood study analysis in the Konaseema flood-affected area near the River Godavari in the Andhra states of India. The river is 1201 km in length and runs from Nashik in India to where it meets the Bay of Bengal. The impact of the recent rainfall on 14th July 2023 was analyzed in the study areas of konaseema and East Godavari districts.

2.1 Software Used-ARC GIS

ArcGIS Desktop is a fundamental tool for creating, analysing, managing, and sharing geographic information so that decision-makers may make wise, well-informed choices. In this study, managed the flood data, made flood risk maps and conduct geographical analysis. To find spatial patterns, trends, and obscure correlations, it is collected the data in a variety of formats and employed analytical tools in GIS. To provides flood risk information for flood disaster management, GIS software tools are used to digitizing the base map. GIS is effective in determining the potential floodplain areas in the watershed [5].

2.2 Flood risk assessment

An evaluation of flood risk determines storm protection strategies, assesses the probability that a specific area would flood utilizing all potential flooding processes, and should provide instructions on what to do before and during a disaster. [6]. In this paper two regions konaseema and East Godavari district developed Flood impacted areas. The main rain event in on 14July2023 has considered and shown risk areas. The risk maps classification in the form of High,
Medium low and Low. During the flood of last year, the Godavari River's water level reached 71.3 feet, the highest recorded since the flooding of 1986, when it reached 75.4 feet. It will be July 14, 2023.

2.3 Study area - Konaseema and East Godavari District

India's peninsula's largest river is the Godavari, Basin encompasses more than 9.50% of the country's total land area, making it the second-largest basin in the world after the Ganges basin. The river rises in the Sahyadris at an elevation of 1,067 meters above mean sea level at Triyambakesvar in the Nashik district of Maharashtra. The river flows through the Deccan Plateau from the Western to the Eastern Ghats. The major river forms an interstate boundary between the States of Telangana Chhattisgarh and Maharashtra. The main river eventually flows through the States of Maharashtra, Chhattisgarh, and Andhra Pradesh, Telangana before emptying into the Bay of Bengal. Figures 1 and 2 presents data regarding coordinate selections in the research area.

Fig. 1. Study area showing in India map

Fig. 2. Study area Map showing in latitude and Longitude.
Fig.3. Study area Land use Map at konaseema DEM of East Godavari district

Fig.4. Study area Land use Map at konaseema East Godavari district

3 Preparation of various thematic maps

Satellite data is used to categorize the land into different groups based on level-3 classification. The land use/land cover map has been created using the (satellite image (A.p report2021) visual image interpretation methods. These methods consider the factors like size, shape, colour, tone, texture, association, and pattern. The broad categories of land use and cover are built-up areas, agricultural lands, wastelands, and water bodies. Fig.3 and Fig.4 displays the spatial distribution of land use and cover in East Godavari district, konaseema based on District Survey Report A - 2021.
The Main objectives of this study are

1. To prepare the DEM Digital elevation model.
2. To Generate maps indicating the direction of flow of water for areas being studied for potential flooding.
3. Preparation of the GIS thematic maps of the flood inundation region and layout maps.

3.1 Digital Elevation Model

A digital elevation model (DEM) is a depiction of the geographical layer of land in three-dimensional elevations. DEMs are produced using several sources, Geographic maps (SOI) from a survey of India and utilized to be the primary data source of USGS DEMs. Fig. 4 shows the information of DEM levels.

Fig. 5. Shows Digital Elevation konaseema District

3.2 Flood Flow Forecasting Location Points

To learn more about the water's flow direction in the chosen location. The ability to discern the direction of flow from each cell in the raster is one of the keys to determining the hydrologic properties of a surface. The Flow Direction tool is used for this. Fig. 5 shows the information study area.

3.3 Flow layout of the Godavari Konaseema area

Fig. 6. Shows Flow layout konaseema District
The output raster of the Flow Accumulation tool estimates cumulative flow as the total weight of all cells flowing into each down-slope cell. Utilize the flow accumulation tool to determine the limitations of the DEM's flow accumulation and direction using the contour and stream orders and the total flow layout of the study area shown in Fig. 6.

### 3.4 Stream Order

To determine the water flow's stream order. Stream order is a technique for giving connections in a stream network a numerical order. Based on the number of tributaries a stream has, this order may be used to identify and categories different stream orders. The mere knowledge of a stream's sequence might reveal some of its properties. Fig. 7 shows the information on the stream order map of 6 sub classes of one to six order streams.

![Fig. 7. Shows Stream Order selection in layout format](image)

By utilizing GIS and remotely sensed photographs, this study demonstrates the need to evaluate the accuracy of uncertain flood estimates. [6]. From the topography (slopes), three distinct production classes have been discovered as a file classed amongst 6 subclasses of Stream orders and natural slopes. Plains with gradients ranging from 0 to 200 m/km are associated with low and intermediate runoff zones [9]. GIS is a useful tool for identifying possible floodplain areas within a watershed [10]. GIS systems were used to apply this goal to examine the region of flood risk locations at the watershed region of the East Godavari district and Konaseema nearby cells by using a direct tools shown in figures. Fig 7 shows the information on the study area first to sixth order streams. Stream order shows the quantity of water discharging in to main streams. It is feasible to vectorize two parallel lines as two neighboring linear features with the same value. Stream order is which allows water into to main stream. water in the basin is found most of them as individual and more main, single, double and third-order streams are huge are observed in the area which will lead to more accumulation in the streams.

### 3.5 Contour Maps of Study area

The depth of the ground floor, the form of mountains, and the steepness of slopes may all be displayed using contours. Fig. 8. shows the contour information on the study...
area demonstrated a rational for assessing both the accuracy and precision of uncertain predictions of flood extent, given remotely sensed images of inundation patterns. Contour classification division into 0-20, 20-40 and 40-60 m interval. In the Fig 8. Contour map of 0-50m classification existed in the konaseema in the study area.

![Contour Map](image)

**Fig. 8.** Contour levels in the study area

### 4 Results and Discussion

![Map of Flood Submerged Areas](image)

**Fig. 9.** Flood zone areas safe and affected and submerged areas.

The purpose of the GIS tool is to use a direct to factorize adjacent and overlapping cells shown. Fig.9 displays the data from the raster data area. Two parallel lines can be vectorized as two adjacent lines with an identical value. Which shows the area boundaries and flood zones of the selected areas from Godavari district of Konaseema District.

#### 4.1 Area calculations by using Attributes and Attribute table

Fig.10: Shows Attributes to calculate the area shows the different areas of polygons for the area calculations the entire affected areas are digitized in the GIS using the polygons and calculated using the area options in the properties of the features. The Total polygon areas are shown as 952 sq.km each block. This impacted the area since the number of
blocks in the basin area had 2689 numbers. impacted areas are shown only 10 numbers which have 952 sq.km different location in along the Godavari river. Fig.9. information about flood classification safe, Effected and Flood submerged areas.

4.2 Flood Area calculations and Attribute table

Flood Area calculations by using Attributes and Attribute table is used in GIS obtain the inundated areas. An evaluation of flood risk determines storm protection strategies, assesses the probability that a specific area would flood utilizing all potential flooding processes, and should provide instructions on what to do before and during a disaster[6]. Geospatial techniques were used to analyze physical environmental domains such as land use, elevation, and proximity to the river channel for increased height accuracy [7]. Waterlines are more sensitive to the channel friction parameter compared to a measure based on area-specific patterns of flood extent.[8].

5 Conclusions

The study area contain more number of divisions, here only 10 sample polygon areas are calculated and shown in the Fig.10. using the digitized map. These maps are Prepared with the help of a Base map using GIS and satellite imageries and survey of India Toposheet. Water resource planers used this information and it is extremely helpful resource managers and action planners. In this study flow direction, flow accumulation, contour maps, stream order, boundary maps are prepared and flow density is calculated. Based on above collected information planners can rescue the flood affected people and take preventive actions in low lying areas.

GIS useful tool for identifying possible floodplain areas within a watershed [10]. GIS systems were used to apply this goal to examine the region of flood risk locations at the watershed region of the East River district, Konaseema East Godavari district[11]. Parameters like flow direction and flow accumulation are used to estimate flood runoff and Parameters like stream order, area boundaries are initially defined. Identifying the risk level in the study area, rescue the people and take preventive measures. In this study Only ten Gis polygons are shown in calculations to understand flood risk levels in the study area shown this data in Fig.10.similaly Fig.11. indicates level of water impact in the East Godavari District. This flood impacted areas are shown as very Low, Low and Medium Low water levels are from 1to2m, 3 to 5m and 6to10m respectively. These maps shows water levels and risk range in color classifications.
Fig. 10. Shows Attribute table to calculate the impacted flooding areas.

Fig. 11. Showing the konaseema and Easy Godavari district flood effecting areas

References