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Flood Risk Analysis of Upper Krishna Sub-Basin using GIS

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Abstract: ***Floods are the most and repeatedly occurring destructive natural disaster due to an overflow of water submerges land which is basically dry. Generally, floods are occurring due to heavy rainfall or cloud bursting or manmade disturbance to nature, fast snowmelt, global warming or tropical cyclone or tsunami. In 2019, the Krishna River has faced very heavy rainfall and major floods which took the lives of approximately 500 people and nearly isolating 350 villages and leaving millions homeless. Here we studied the previous flood disaster at the basin of the Krishna River and processed the GIS environment using software tools. This facilitates exploring the data and methods that are mostly unexplored, and areas that have not lightened in the field of flood studies in Krishna basin. It is impossible to avoid floods and risk associated with flood, however it is possible to work on the flood reduction. Flood hazard mapping is to identify comparatively safe sites in high elevation with low risk is one of the powerful tools for this purpose. Flood hazard mapping flash flood will be beneficial for risk assessment. Management and emergency services during flood events. The objective of this paper is to generate flood hazard zonation maps of Upper Krishna sub-basin using GIS tools and satellite images. To do so, we use spatial data and SRTM DEMs with accuracy assessment is achieved by using check points, obtained by GPS observations. Runoff, surface slope, drainage density, distance to main channel and land use were considered causative factors. All used data are processed and integrated in an ArcMap and QGIS to prepare a final flood hazard map for Upper Krishna sub-basin. The areas in high risk flood zones are obtained by overlaying the flood hazard index map with the zone boundaries layer..***

Keywords: ***Hazard, GIS, Risk, index map, Basin, Flood***

I. INTRODUCTION

Floods are responsible for economic loss, loss of life and damages to property and critical public health infrastructure, disturbance to ongoing activities. As per the record 1998 to 2017, floods affected more than 2000 million people worldwide. Mainly people who get affected due to lack of flood warning systems and lack of awareness of flooding hazards. Mostly the people living in the floodplains, are most vulnerable to floods.

Flash floods are very destructive in nature, because they combine high velocity flow due to flooding with the destructive power of a flood. Generally flash floods occur due to the exceeding water absorbing capacity of land due to saturation of soil and due to enough water accumulating for streams to overtop their banks, which causes sudden rise of water in a small time. This can happen within a very short time which is very short to warn the people. As per the record of World Health Organization (WHO) 80-90% of all documented disasters from natural hazards during the recent 10 years have resulted from floods, tropical cyclones, and severe storms. During the last 10 years, the frequency of flood increases considerably, also the intensity of flood increases. Research shows this kind of extreme precipitation is expected to continue due to climate change.

Maharashtra is very prone to floods as well as to drought. Past study shows 7 % of the total area of Maharashtra is prone to flood. Due to changed rainfall pattern Maharashtra could face increase in rainfall variability, as well as increased likelihood of flooding in the future. Also this heavy rainfall leads to high runoff and less water table recharge and will increase drought problem. Because of flood primarily non-functioning of infrastructure facility which includes water supply and drainage, electricity supply, pumping station affected

Maharashtra from 2019. Nearly 251 people have died and over 100 are still missing due to floods and landslides. Thirteen districts have been worst affected in the part of Maharashtra. Satara, Sangli and Kolhapur were mostly affected by flood, and more than 1,020 villages were affected due to heavy rainfall. Also over 206,000 people from Sangli district and around 150,000 people from Kolhapur district evacuated during the flood. As per the record, over 200000 hectares of crops have been damaged in these floods. Krishna Basin, mostly Sangli & Kolhapur districts also faced heavy flood situations in the past 2005 & 2006 and it was noteworthy. However, the 2019 flood event was found much severe which live more than a week and losses experienced were also on a higher scale.

II. STUDY AREA AND DATA SET

An easy way to comply with IJRASET paper formatting requirements is to use this document as a template and simply type your text into it. Krishna river rises in the near of Mahabaleshwar town part of western Maharashtra state having altitude of 1337 m above MSL (13°.7‟/N to 19°20 „/N and 73° 22‟/E to 81°10‟/E) and flows in Maharashtra state, Karnataka state, Andhra Pradesh state and join into the Bay of Bengal in Andhra Pradesh state. Krishna Basin has covered an area of 2.59 Lakh sq. km, and extends over Andhra Pradesh, In the Maharashtra state and Karnataka state covers 2, 58,948 Sq.km area of the country. The total length of the river is about 1400 km. This large basin lies in the states of Karnataka (113,271 km2), Telangana and Andhra Pradesh (76,252 km2) and Maharashtra (69,425 km2). The Krishna basin is nearly having triangular in shape and is bounded by Balaghat range on the north, by the Eastern Ghats on the south and the east by the Western Ghats on the west.(indiawris.gov.in/wiki/doku.php?id=krishna)

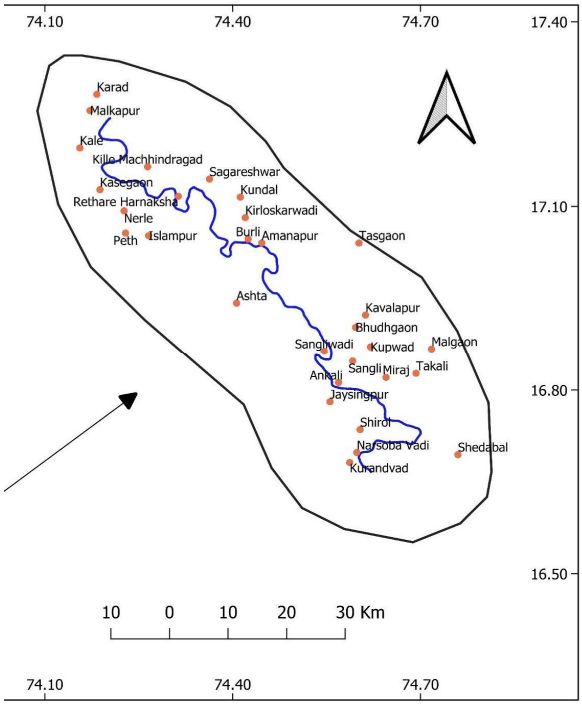

Fig -1: Study Area Map

III. METHODOLOGY

All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified. The methodology for Flood hazard zonation map are being consist of mainly following steps

Study of Geoinformatics and remote sensing applications for disaster-affected settlement. This includes studying the basics of remote sensing and GIS. Also it includes study of applications of GIS on actual flood events.

Study of the past flood events and disaster risk with rainfall data, precipitation and various causative factors in the study area. It includes behavior of past floods and past mitigation recommendations, also includes rainfall data collection and utilization in flood related study.

In the Third phase, Interpretation & analysis of spatial data source for disaster affected settlement in the GIS environment will be carried out. Interpretation and analysis of spatial data includes Preparation of various maps related with flood study, Assignation of proper weightage for these maps and over laying of all maps with their respective weightage in software tool.

A. Working with ArcGIS 10.8 software

ArcGIS 10.8 software is the same as QGIS software with few additional commands and also it is commercial or paid software. Various maps were created by this software which is useful for flood risk assessment and modeling of upper Krishna basin from Karad to Kurundwad river stretch. The maps created using ArcGIS is as follows

1) Digital Elevation Model
2) Contour map

3) Slope map
4) Aspect map

B. Digital Elevation Model

Digital elevation models are in combination with other spatial data, an important database for topography related analyses or 3D video animations (e.g. fly-troughs). Different geo referenced 3D products can be derived and complemented by a coordinate system and presented in a 2D map projection or as a 3D perspective view. In ArcGIS, DEM wants to go to Arc Toolbox, spatial analyst tool, Extraction and extract by mask, select appropriate digital elevation model which was downloaded from Bhuvan..

C. Contour map

After completion of the digital elevation model of the study area we created a contour map with the help of spatial analysis tool in ArcToolbox.

D. Slope and Aspect

An aspect-slope map simultaneously shows the aspect (direction) and degree (steepness) of slope for a terrain. Aspect categories was symbolized using hues (e.g. red, orange, yellow, etc.) and degree of slope classes are mapped with saturation (or brilliance of color) so that the steeper slopes are brighter .Aspect is the directional measure of slope.

E. Aspect

Aspect is the direction that a slope faces. It identifies the steepest downslope direction at a location on a surface. It can be thought of as slope direction or the compass direction a hill faces. Aspect was calculated for each triangle in TINs and for each cell in raster.

F. Flood hazard zonation map:

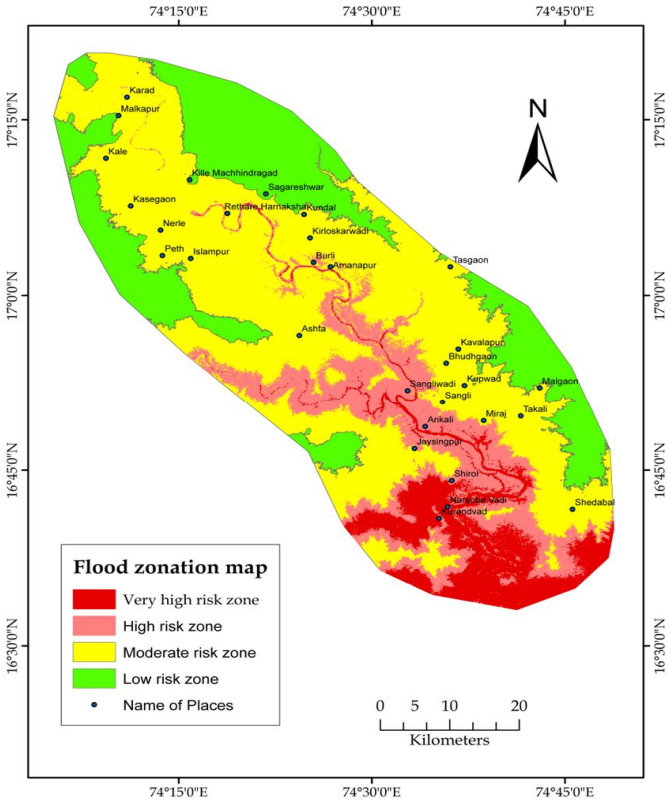

Fig. 1 Flood zonation map

IV. CONCLUSIONS

Main rivers flowing in Sangli district named Krishna and Warana. Confluence of Krishna and the Warana River was seen near Sangli City. Level of the River Bed at Irwin Bridge is 527.06 m. The flood situation arising in Sangli is because of topography, backwater of Almatti Dam and Confluence of Krishna, Warana and Panchganga Rivers near to Sangli. The Digital Elevation Model depicts the highest elevation point is 923m and lowest elevation is 495m. For preparation of flood risk maps, we take a raster analysis process in ArcGIS. This process includes creation of a logical risk map. We consider different elevation levels like 540m, 550m and 560m to prepare flood hazard zonation maps of study areas. We consider this level because the level of the riverbed at Irwin Bridge shows 527.06m. Based upon above analysis and observations flood hazard zonation maps have been prepared (Figure. 2). It includes four flood risk zone maps as Very high-risk zone, · High risk zone, Moderate risk, Low risk zone.

V. ACKNOWLEDGMENT

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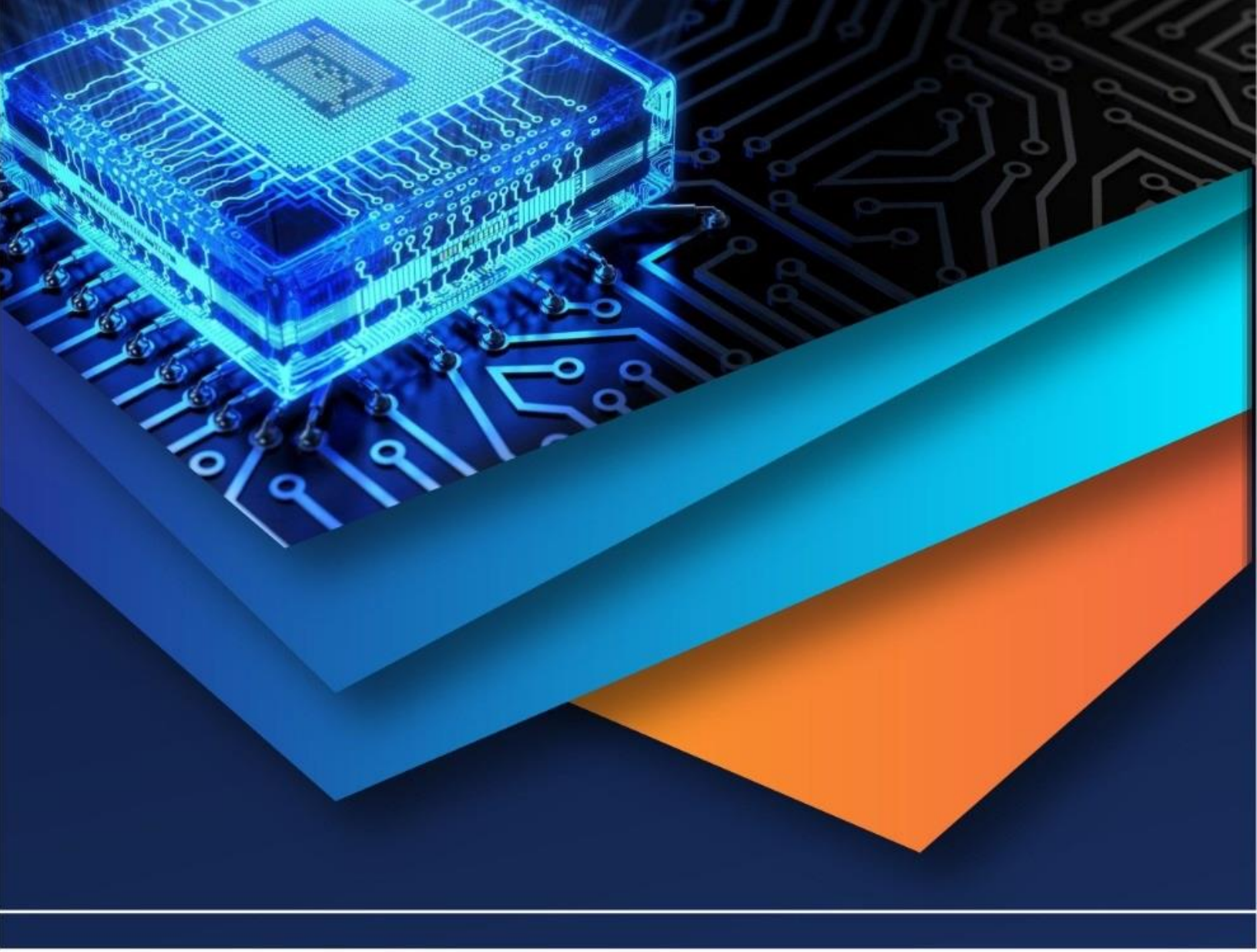

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