International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Mapping of Flood Risk Zones of Chandrabhaga River Around the Pilgrim City of Pandharpur by Using Remote Sensing, DEM and GIS Techniques

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Abstract: ***In the past, there have been severe climatic conditions occurring in most part of the earth due to climate change. As a result of this, the intensity of rainfall has increased tremendously causing flooding in many areas and countries worldwide. Therefore, it is very important to have a thought on such a natural hazard to minimize the impact which it creates on public and environment. In order to prepare from such calamity, vulnerable areas for flood affection need to find out. In flood risk management activity demarcation of flood prone areas plays an important role. Therefore, in this research paper, efforts were made to find out the flood prone areas by using remote sensing, (DEM) digital elevation model data and GIS techniques. LISS III satellite data, Cartosat DEM have been used to generate the slope gradient of the study area. To get the different level of flood risk map, the slope gradient map has been reclassified in low risk, medium risk and high risk zone maps. It is recommended to the people residing in high risk areas to relocate into low risk area.***

Keywords: flood prone area, DEM, Remote sensing, GIS techniques**.**

1. Introduction

High rainfall and consequent floods are recurrent phenomenon in India causing loss of lives and damage to livelihood, property, infrastructure and public utilities. Floods and droughts affect vast areas of the country, transcending state boundaries [1]. One-sixth area of the country is drought-prone. Out of 40 million hectare (12% of geographical area) of the flood prone area in the country, on an average, floods affect an area of around 7.5 million hectare per year. Approach to management of droughts and flood has to be co-ordinated and guided at the national level [2].The flood-related damages are showing an increasing trend during 1996-2010 due to global warming, rapid increase in population and urbanization coupled with intensive developmental and economic activities in the flood plains [3].

North-south flowing Krishna and South-east flowing Bhima are major rivers of south Maharashtra. Krishna rises near Mahabaleshwar. Bhima River rises near Bhima Shankar in Pune district and flows through Pune and Solapur district. Ghod, Man, Pawana, Neera and Sina are the main tributaries that join Bhima which is flood prone river [4]. The length of Bhima in Maharashtra is 451 Km. Pune, Shirur, Daund, Pandharpur are flood prone cities/towns in Bhima river basin. Panshet, Warasgaon, Temghar,Mulshi, Pawana, Chaskaman, Dimbhe, Manikdoh, Pimpalgaon Joge, Ghod, Ujjani, Nira Deoghar, Bhatghar, Veer, Gunjawani are major dams in Bhima basin. The Krishna and Bhima basin experienced heavy floods in 2005 and 2006 year which caused heavy loss to lives and property. North-south flowing Krishna and South-east flowing Bhima are major rivers of south Maharashtra. Krishna rises near Mahabaleshwar. Bhima River rises near Bhima Shankar in Pune district and flows through Pune and Solapur district. Ghod, Man, Pawana, Neera and Sina are the main tributaries that join Bhima which is flood prone river [4]. The length of Bhima in Maharashtra is 451 Km. Pune, Shirur, Daund, Pandharpur are flood prone cities/towns in Bhima river basin. Panshet, Warasgaon, Temghar,Mulshi, Pawana, Chaskaman, Dimbhe, Manikdoh, Pimpalgaon Joge, Ghod, Ujjani, Nira Deoghar, Bhatghar, Veer, Gunjawani are major dams in Bhima basin. The Krishna and Bhima basin experienced heavy floods in 2005 and 2006 year which caused heavy loss to lives and property. Eighty per cent of the precipitation takes place in the monsoon months from June to September. The rivers bring heavy sediment load from the catchments. These, factors coupled with inadequate carrying capacity of the rivers are responsible for causing floods, drainage congestion and erosion of river-banks [6]. In this research assessment, we have adopted the broader view and where possible we have addressed research needs as they relate to the enhancement ofthe total productivity of the flood-prone lands. This orientation helped setpriorities for the research recommended, as well as in identifying theresearch needs.

2. Study Area

The area of study is bounded in between latitudes $17^0$35’ to $17^0$44’ N and longitudes $75^0$14’ to $75^0$22’ E. It forms part of Survey of India Toposheet no. 47 O/2 and 47 K/14 and covers an area of 125.82 Km2. Major part of the area is in Pandharpur Taluk of Solapur district as shown in fig.1

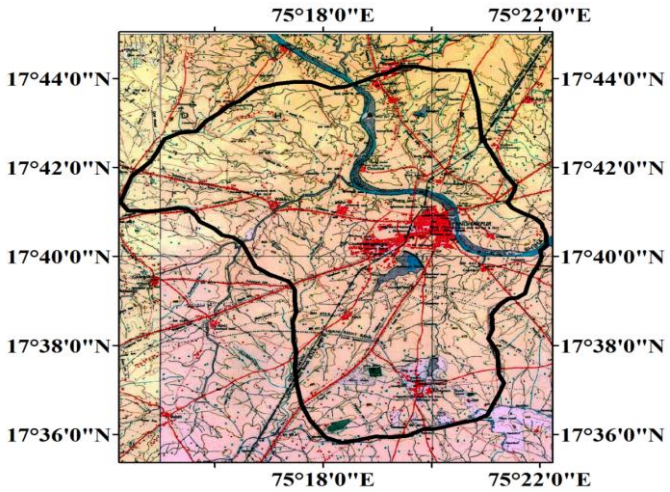


Figure 1: Study area map

3. Geology

The Deccan Basalt is formed from fissure type of eruption that occurred in a sequential phase at about 65 million years ago. The flows are generally parallel to sub parallel in nature and deposited horizontally respectively. The thickness of basaltic flows varies from place to place as 2 mts to 20 mts. Each flow unit is made up of vesicular basalt on top and massive basalt at bottom and the flows are separated by red/green bole.In the present study area, the Basalt is having massive grey coloured, pinkish vesicles and filled by secondary minerals. The 26 dug wells have been examined to get the knowledge about the sub surface lithology. The area constitutes flows that range in thickness from 2 mts to 24 mts. The geological succession in the study area is as mentioned in table no. 1

Table 1: Geological succession of the study area

Altitude range	*Thickness (m)*	*Type of flow*
531m to 559m	1.00	Weathered zone/ loose soil
559m to 530m	19.00	Poorly jointed massive basalt
530m to 520m	10.00	Vesicular basalt with amygdals
520m to 505m	15.00	Poorly jointed massive basalt
505m to 503m	2.00	Red bole
503m to 500m	3.00	Fractured/jointed massive basalt.
500m to 495m	5.00	Red bole incrusted with zeolitic basalt
495m to 490m	5.00	Vesicular basalt with amygdals
490m to 480 m	10.00	Red bole incrusted with zeolitic basalt
480m to 470m	10.00	Massive basalt

The flows are almost horizontal which follow the topography of the area. The physical characteristics in terms of lithology and porosity, permeability of the basalt are not uniform throughout in spatial occurrence of the flows thereby showing local variations in aquifer characteristics. The major lithology of the area is showed in table no. 2.

Table 2: Major Lithology of the area

Sr. No.	Formation	Age	Lithology
1)	Alluvium	Recent	Clay, silt, sand with pebble
2)	Deccan Trap	Upper cretaceous to lower Eocene	Vesicular and Amygduloidal basalt and massive basalt. The flows are generally separated by red bole.

4. Methodology

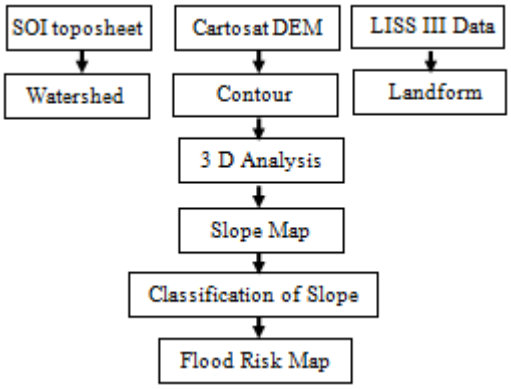
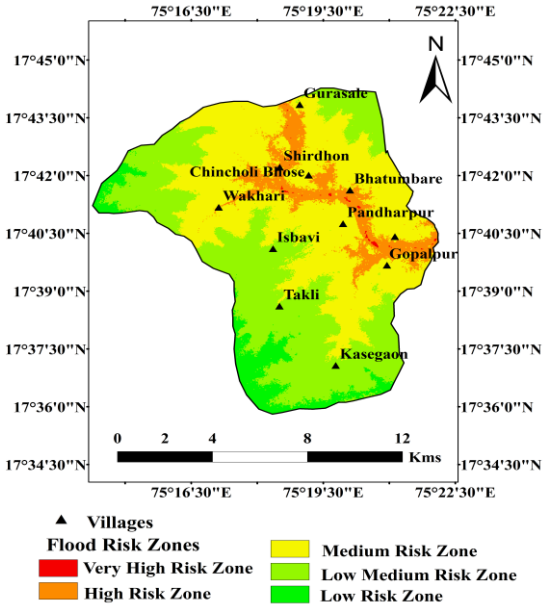


Figure 2: Approach to get flood risk map

The survey of India toposheet 47 O/2 and 47 K/14 have been used as the base map to formulate watershed boundary and drainages. The Cartosat (DEM) digital elevation model and LISS III satellite data is also used as these datasets can be processed in computer by using Geographical information system software Arc GIS version 10.0. The contour map is generated using DEM data. Various landforms in the study area have been studied from LISS III satellite data. The various flood risk zones have been mapped accordingly as thematic map. The methodology to obtain the flood risk map is shown in the fig.2.

5. Results

The GIS technique has been used to obtain the flood prone risk zone map near the Pandharpur, the Pilgrim city of the Solapur district. The flood risk zone has been classified into five classes from the study of digital elevation model of Cartosat and classified as very high risk zone, high risk zone, medium risk zone, low medium risk zone, and low risk zone based on the slope gradient. The high risk zone area covers part of Shiradhon, Bhatumbre, Pandharpur and Gopalpur village. The medium risk zone area covers the part of Wakhari, Gurasale and Chincholi Bhose village of Pandhapur taluk of Solapur district.



6. Conclusions

This study envisioned to demarcate the flood risk zone areas on Chandrabhaga river basin by using Survey of India toposheet, Cartosat DEM and LISS III satellite data. GIS technology is being used to identify the susceptible zones for flood vulnerability. The study distinguished the least risk prone area and the high risk prone area for flood occurrence. The result from the study can be useful to the people residing in the villages which are prone to flood i.e. Gurasale, Shiradhon, Chincholi Bhose, Bhatumbre, Pandharpur and Gopalpur villages. The study concluded that the extreme water accumulation in the basin in association with abrupt occurrence of surplus rainfall is the key cause for flash flood existence. Therefore, the potential flood risk area need to take into consideration for any disaster and preparedness plan and pre-warning notice.

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Author Profile

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