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RAINFALL VARIABILITY IN SPACE AND TIME, A CASE OF MYSORE DISTRICT, KARNATAKA, INDIA

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Abstract - The present study has been conducted to assess the spatial variations in rainfall in Mysore district, Karnataka, India. In order to discuss spatial and temporal variations in rainfall, 13 rain gauge stations have been chosen to collect data for the years 2000 to 2012. Data have been collected mainly from the District Statistical Office, Mysore. These collected data have been used to examine year-wise spatial variations of rainfall using Inverse Distance Weighted (IDW) method in ArcGIS. Co-efficient of variation has also been computed to assess the area where average rainfall can be expected, in the future. The result shows that the study area has fluctuations in rainfall and 1,156 km2 have low variations, 5,026 km2 have moderate variations, and 58.93 km2 have high variations.

Key Words - IDW, Coefficient of Variation, Interpolation technique

1. INTRODUCTION

Rainfall is an important element of economic growth of an area or region, especially in a country like India, where a large number of people are occupied in agricultural activities. The amount of rainfall does not show an equal distribution, either in space or in time. It varies from heavy rain to scanty in different parts. It also has great regional and temporal variations in distribution. The study of rainfall distribution pattern and its temporal variations is very important, as the country's economy is highly dependent on agriculture. The rainfall trends are often cited as one of the more important factors in explaining various socio-economic problems like the food insecurity. Therefore, the study has been conducted in order to help policymakers and developers to make more informed decisions, especially, the results will help farmers to take necessary steps for cultivation process.

2. PURPOSE OF STUDY

The purpose of the study is to discuss the rainfall variability in Mysore district, Karnataka, India. The rainfall data have been collected from 13 rainfall gauge stations in the district which could be analyzed and interpreted.

3. STUDY AREA: MYSORE DISTRICT, KARNATAKA

The study area lies between the North latitudes 11° 44' N and 12° 37' N and East longitudes between 75° 57' E and 77° 12' E (Figure:1) . The district is bound on the north by Mandya and part of Hassan districts and on the east by Chamarajanagar. Kodagu forms its western boundary and the southern portion is covered by Kerala and part of Chamarajanagar district. The total geographical area of Mysore district is 6,241 km2, which has been calculated using GIS. GIS calculates the area based on the plain surface so that this area may change when compared with topographical area of Mysore district. The climate of the district is moderate throughout the year, and the district gets rainfall during two seasons, namely, the southwest monsoon season or rainy season, which is between June to September and retreating monsoon season during October and November.

4. RESEARCH METHODOLOGY

The average annual or seasonal rainfall at a place does not give sufficient information regarding its capacity to support any decision making process, so keeping that in mind 30 locations of rainfall data has been collected between 2000 and 2012 from District Statistical Office, Mysore.

The researchers have been using various method of interpolation (David et al., 2004) to measure continues surface value from the discrete data. There are several studies which have been conducted using IDW method to assess the rainfall distribution (Feng-Wen Chen, 2012), especially the study conducted by Azpurua M, 2010, concluded that IDW interpolation method is most likely to produce the best estimation of a continuous surface of the average magnitude of electric field intensity. Hence this study followed IDW method to examine year wise spatial variation of rainfall using Inverse Distance Weighted (IDW) method in ArcGIS. The co-efficient of variation is one of the popular method (Mishra, 1991) which used to measure the variation in the values, so this study also used co-efficient of variation to find out the temporal variation in the rainfall and the result of the analysis has been mapped to find out the spatial variations of co-efficient values.

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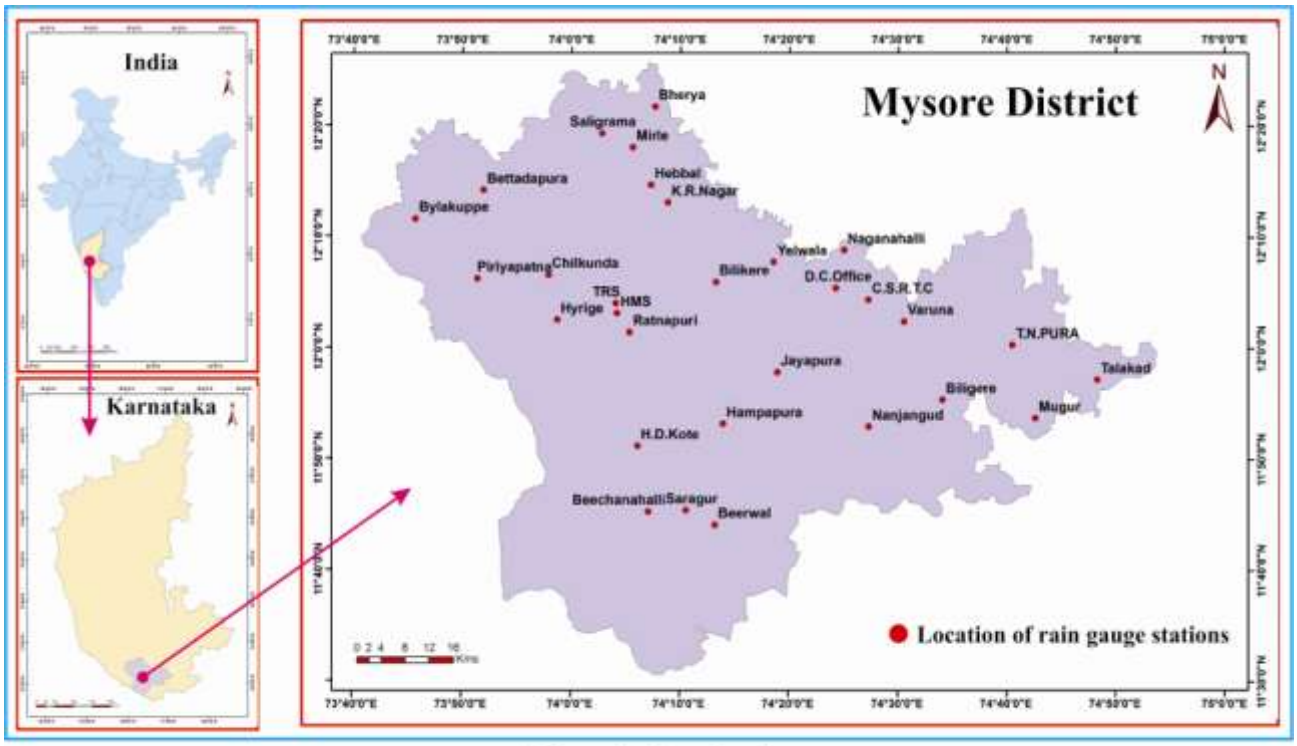


Fig: 1 Study Area

5. Result and Discussion: Spatial Variations In Rainfall

There are thirteen rain gauge stations located in different places in Mysore district, and these stations measure the precipitation throughout the year, the spatial location and name of the rain gauge stations are shown in Figure 1. The rain gauge stations measure rainfall only in their locations, and so it is necessary to adopt some mathematic model to calibrate rainfall for the entire region. There are several methods and among them the IDW has been a popular method. The results of the IDW are highly acceptable to the scientific community. Therefore, the study has used the IDW technique to measure the spatial variations in rainfall in the district using the rainfall data from the 13 rain gauge stations.

Spatial Variations: The analysis of year-wise spatial variations in rainfall shows that the study area has annual as well as seasonal fluctuations in rainfall, every year, which vary between 'slight' and 'extreme'. The spatial variations in rainfall (Figure 2) have been classified into five classes to group the vast area into few classes for analysis purpose, such as 'very low' (< 400 mm.), 'low' (400 mm – 600 mm), 'moderate' (600 mm – 800 mm), 'high' (800 mm – 1,000 mm) and 'very high' (> 1,000 mm).

Temporal Variations: The temporal classification of year wise rainfall distribution shows that (Table 1), during the year of 2005 huge area have been covered by high and very high rainfall, while during the year 2012 vast area have been covered by low and very low rainfall. The years 2000, 2004, 2006, 2010 and 2010 the study area had received rainfall from very low classes to very high classes, whereas during 2001, 2005, 2007, 2008 and 2009 the study area had not received very low level of rainfall and during 2002, 2003 and 2012 no area covered by very high level of rainfall.

The data also indicate that, during the years 2000, 2001, 2005, 2007, 2009, 2010 and 2011, vast areas have been covered by 'high amount of rainfall', which is 800 mm to 1,000 mm and during the year 2003, 2004, 2006 and 2008 huge areas have been covered by a moderate amount of rainfall while large area have been covered by low amount of rainfall during 2002 and 2012.

The long term study of spatial variations in rainfall shows that large areas have been covered by 'high' (800 mm – 1,000 mm.) amount of rainfall in seven years and 'moderate' (600 mm – 800 mm) in four years while 'low' (400 mm – 600 mm) have covered large areas in two years. The distribution of rainfall over time clearly shows that high, moderate and low classes (between 1000 – 400 mm) of rainfall play a major role in the study area than very low and very high classes.

6. Coefficient of Variation

The rainfall coefficients of variation have been calculated using selected 30-year data to measure the spatial variations in rainfall in the study area. The coefficient of variation (CV) is defined as the ratio of the standard deviation to the mean, so each rain gauge station's

standard deviation and mean values have been calculated using the 30-year data. Then the coefficient of variations

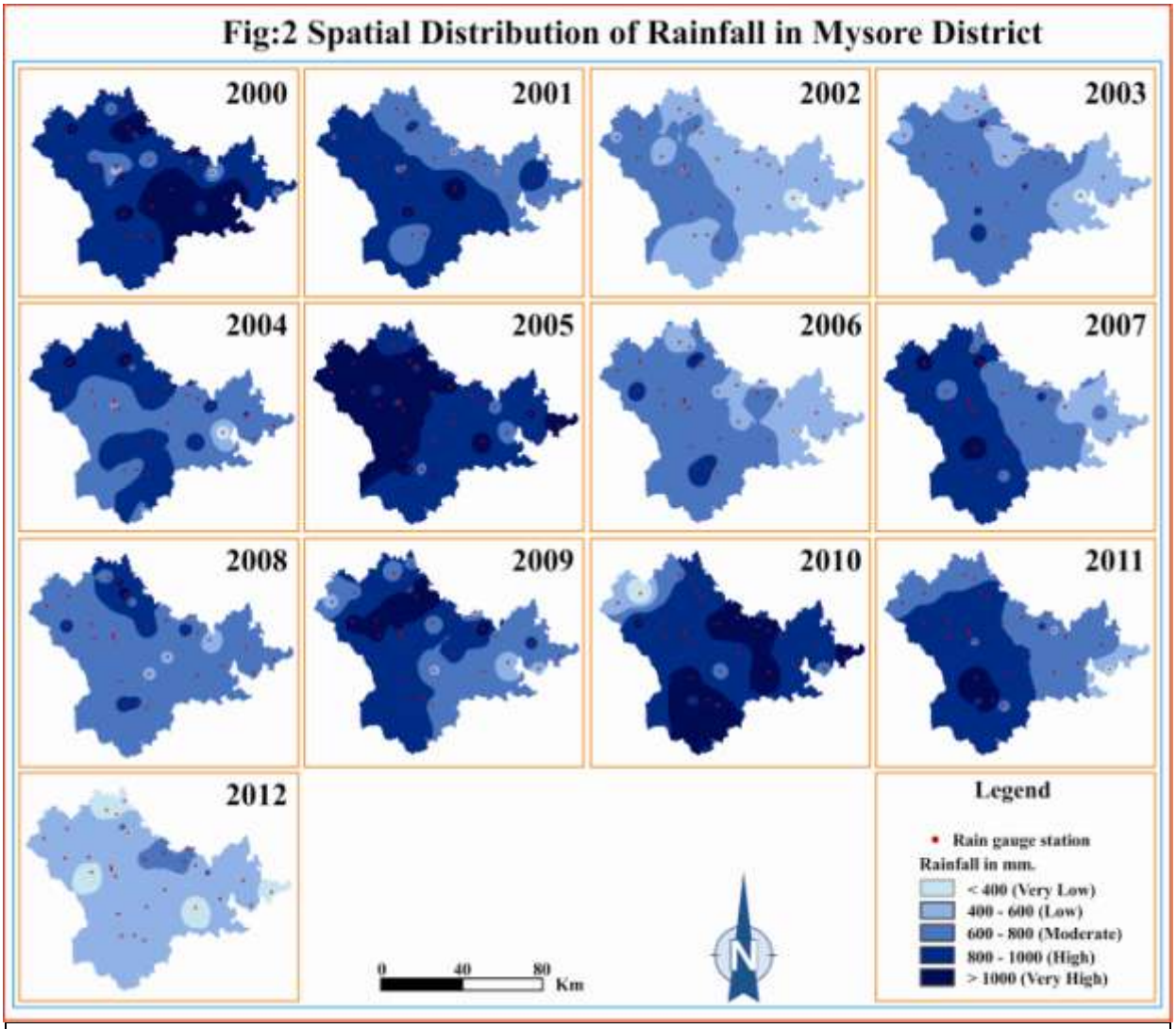
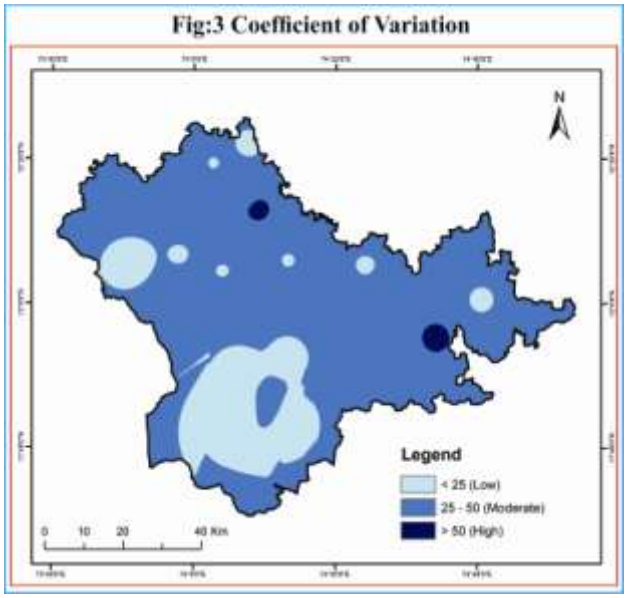


Table 1: Classification of Year-wise Rainfall Distribution (Area in km^2)

S.No	Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1	Very Low	5.78	-	82.86	41.26	34.99	-	6.27	-	-	-	119	13.5	742
2	Low	27	32	3914	1807	125.6	-	1689	841	164	253	258.7	278	5171
3	Moderate	360	2349	2244	4303	3330	156	4274	1829	5265	2337	405	2492	329
4	High	4155	3735	0.33	90.45	2690	3299	264.7	3371	782	2978	3573	3151	-
5	Very high	1694	125	-	-	64.74	2787	7.59	200	29.7	674	1886	307	-
Source: Analytical Result														

values has been found using the results of standard deviation and the mean values. The results of CV have been plotted on its appropriate location to prepare the spatial variation of rainfall (Figure 3).

Fig:3 Coefficient of Variation



The result of coefficient of variation analysis varies from 60.84 to 17.78. The results of spatial variations analysis have been classified into three classes, namely, < 25 (low) where the variation of rainfall is lower than in other places, 25-50 (moderate) where the variation is 'moderate' and high (> 50) where the variation is higher than in other places. The study also shows that the area covered by 'low variation' is 1,156 km2, 'medium' is 5,026 km2 and 'high' is just 58.93 km2.

Table 2: Coefficient results

S.No	Classes	Area Km^2
1	Low	1156
2	Moderate	5026
3	High	58.93

Source: Analytical Result

7. Conclusion

The spatial variations of year-wise rainfall show that the study area has fluctuations in rainfall both in space and time in all areas of the rain gauge stations. The coefficient of variation result shows that 1,156 km2 of the district area has been covered by 'low' variations, where average amount of previous year's rainfall can be expected and 5,026 km2 of the geographical area has been covered by 'moderate' variation, where the average amount of rainfall of previous years is may not be judge accurately whereas 58.93 km2 of the area has been covered with 'high' variation, where the rainfall may not be the normal amount of previous years. The result of this study can help the people, those who depend on rainfall, especially the farmers to take necessary steps in their cultivation of crops in the coming years.

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