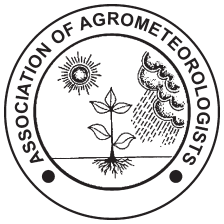
Volume 15 **Special Issue - II** **December 2013**



Journal of Agrometeorology

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Journal of Agrometeorology 15 (Special Issue-II) : 230-234 (December 2013)

Short Communication

Long-term rainfall analysis of Ranga Reddy district of Andhra Pradesh using GIS

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Being a tropical country, India mainly depends upon the rainfall for the water resources. More than 80% of the annual rainfall occurs during the monsoon periods in Andhra Pradesh. Intensity of monsoon rainfall is uneven and erratic both in space and time (Vennila, 2007). One of the sources of information on climatic-scale is rain gauge observation, which has advantages and shortcomings. Long-term gauge data of particular region can be important source to understand the nature variation of monsoon. Knowledge and understanding of such variability can lead to improved risk management practices in agriculture and other industries. Thus it is essential to analyse the occurrence of rainfall during various seasons for evolving a system to manage the water resources effectively.

Blanford (1886) was the first meteorologist who made extensive studies of Indian rainfall. Sir Gillbert Walker (1910,1914,1922) examined the south-west monsoon rainfall of British India (the whole country as one unit) by considering all available rain gauge data for the period off 1841-1908. After walker's studies, little work was done during next 50 years. Later, analysis of average rainfall of India (as one unit) was done by Parthsarathy and Dhar (1976), Parthasarathy and Mooley (1978) and Mooley and Parthasarathy (1979) with variable number of rain gauge stations. Jagannadha Sarma (2005) has analysed the rainfall pattern of the coastal zone of Krishna-Godavari River Basin of Andhra Pradesh, India. He analyzed the annual, monsoon and non-monsoon rainfall and spatial and frequency distribution of rainfall intensity and Venila (2007) analyzed rainfall variation analysis of Vattamalaikarai sub-basin, Taimil Nadu, India. Ishappa (2010) has studied the rainfall characteristics of the Coimbatore District, which include the spatial distribution and variability through different seasons. However detailed study on the occurrence and distribution of rainfall in Ranga Reddy District has not been done. The present paper analyses the pattern of rainfall distribution over space and time. These results were taken to Geographical Information System (GIS) platform to prepare spatial distribution maps. GIS provides greater reliability with lesser time and cost compared with manual operation (Bera *et al.,* 2003). Keeping this in view this study aimed to use GIS for spatial analysis of rainfall variation in Ranga reddy district of Andhra Pradesh.

Study area

The Ranga Reddy district is located in Central part of Deccan plateau of Andhra Pradesh and lies between 16^0 30' and 18^0 20' of North Latitude and 77^0 30' and 79^0 30' of East Longitudes. The district covers an area of 7493 Sq. Kms. The district is bounded on the North by Medak District, East by Nalgonda District, South by Mahaboobnagar District, and West by Gulbarga District & North West of Bidar District of Karnataka State. There are 37 mandals, 3 Revenue divisions and 12 Muncipalities in the district. Study Area is shown in Fig. 1.

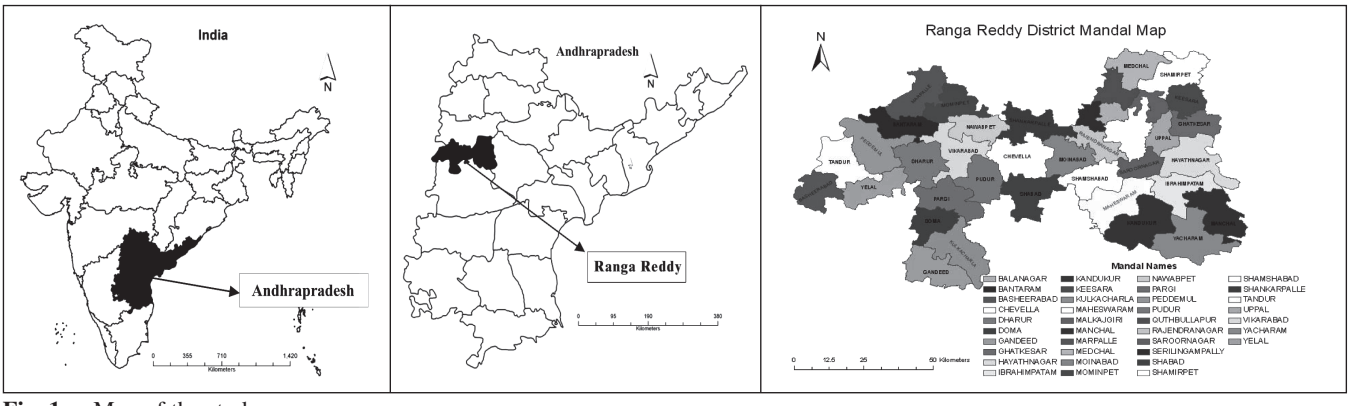

Fig. 1 : Map of the study area

Thirty seven rainfall stations selected for the present study. Daily rainfall data for the period of 25 years from 1985 to 2010 were collected from Meteorology section, ANGRAU, Rajendranagar, and Bureau of Economics and Statistics, Hyderabad. Thirty seven rainfall stations have been taken into consideration for analyzing long term mean monthly, seasonal and annual rainfall pattern. The daily rainfall data has been tabulated as monthly for the respective raingauge stations. The tabulated data were analyzed to calculate mean rainfall, seasonal rainfall, and coefficient of variation. The rainfall data is stored in the database and the database is added to the mandal map using mandal latitude and longitude values and converted to point shape file.

GIS interpolation technique Inverse Distance weighting (IDW) is applied to map spatio-temporal variation rainfall of Ranga Reddy District.

Variation in monthly rainfall data

The average monthly rainfall of 25 years (1985 to 2010) for 37 rain gauge stations of Ranga Reddy district showed that the variation of rainfall is found in every month, and intensity of rainfall gradually increasing from January to August, and suddenly decreasing trend noticed from September to November. The higher intensity trends were noticed in July and August which receive highest rainfall and reaches peak. Lowest rainfall trends were noticed in January. Lowest rainfall recorded at Kandukur in the month of January and its maximum rainfall recorded in the month of July in Vikarabad.

Mean annual rainfall

The mean annual rainfall for the all stations shown in Fig 2. The long term mean annual rainfall of Rangareddy District is about 796.47 mm of which the winter, summer, southwest and northeast monsoon contribute 1.20, 7.40, 74.40 and 17.00% of the annual rainfall respectively. It is interesting to note that among 37 rainfall stations, the maximum of 967.42 mm is recorded at Vikarabad, whereas the minimum of 567.09 mm of rainfall at Shamirpet.

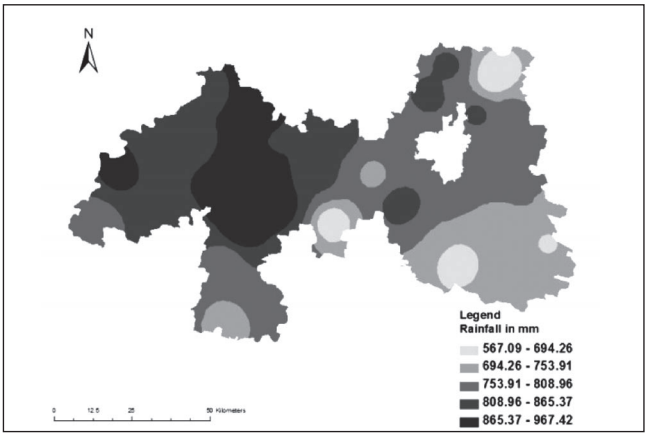

Fig. 2 : Mean annual rainfall

Mean seasonal rainfall

Winter season

The winter season contributes small amount, of rainfall to the annual share. The winter rainfall in the months of January and February is only 1.2 %. During the winter season the region heavily experiences low rainfall and it is among the all season which is maximum recorded at adjacent area of the region in Manchal 13.7 mm and lowest recorded at Shabad which is 5.2 mm. The spatial pattern of winter rainfall is unique and totally different from other seasons. The winter seasonal pattern of rainfall of the study area is shown in Fig 3a.

Summer season

Summer receives more rainfall than winter season. The amount of rainfall gradually increases. This season contributes 7.40% of mean annual rainfall. The highest rainfall is recorded at Hayatnagar which has mean rainfall 90.6 mm the lowest rainfall is recorded in Kandukur 11.7 mm. There is a much variation in the rainfall amount during summer and winter. The summer seasonal pattern of rainfall of the study area is shown in Fig 3b.

South West Monsoon season

Huge amount of rainfall variation noticed in this season, half of northern part of district receives low rain and half of southern part receives heaviest rainfall during season. The average rainfall of this season 592.41 mm and it is 74.40 % of mean annual rainfall. The highest seasonal rainfall recorded in Vikarabad 735.27 mm, lowest seasonal rainfall recorded in shamerpet 408.81 mm. The South west monsoon season pattern of rainfall of the study area is shown in Fig 3c.

North East Monsoon season

Total rainfall in this season is low compared to the south west monsoon. This season contributes 17.06% of mean annual rainfall and average rainfall this season is 135.89 mm rainfall. The highest rainfall recorded area at shamshabad 188.0 mm, Hyatnagar 184.1 mm where as lowest rainfall is recorded in Shabad 96.7 mm. The North East monsoon season pattern of rainfall of the study area is shown in Fig 3d.

Annual variability of rainfall

The mean annual variability of the study area is calculated for 37 rainfall gauge stations located in the study area. Coefficient of variability is calculated from long term

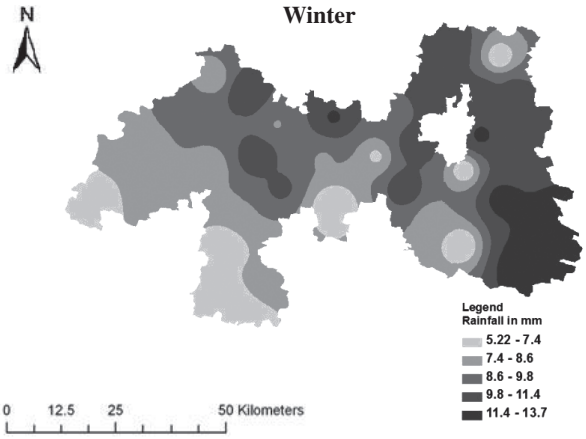

Fig. 3a : Winter seasonal pattern of rainfall

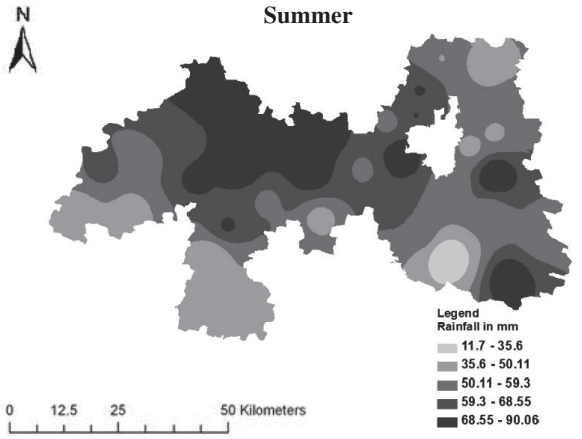

Fig. 3b : Summer seasonal pattern of rainfall

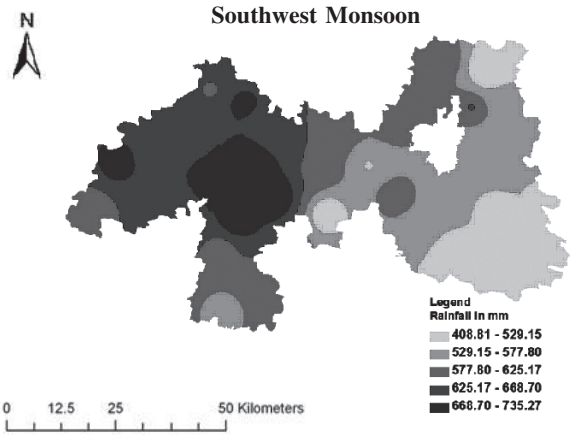

Fig. 3c : Southwest seasonal pattern of rainfall

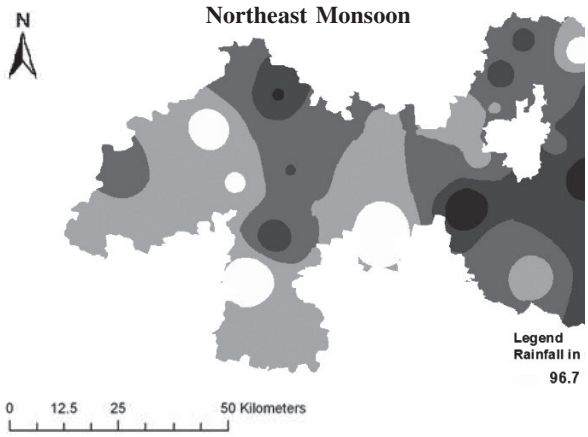

Fig. 3d : Northeast seasonal pattern of rainfall

Fig. 3 (a to d) : Seasonal rainfall

mean annual rainfall and standard deviation of the each rainfall station.Annual rainfall variability of region is 31.22% and it varies from 22% to 53% in the study area. The minimum variability was found at Peddumul in west (22.08%), and maximum was found at Malkajgiri in the south (53.40%). The mean annual variability shown in Fig 4 .

Winter season rainfall variability

Among seasons winter variability of rainfall is high. The rainfall variability during this season is highly fluctuating because of low rainfall. During this season, the variability is triple fold than summer, southwest and northeast monsoon. The mean rainfall variability of winter season is 188.08% and varies between 136.37% and 258.93%. The minimum

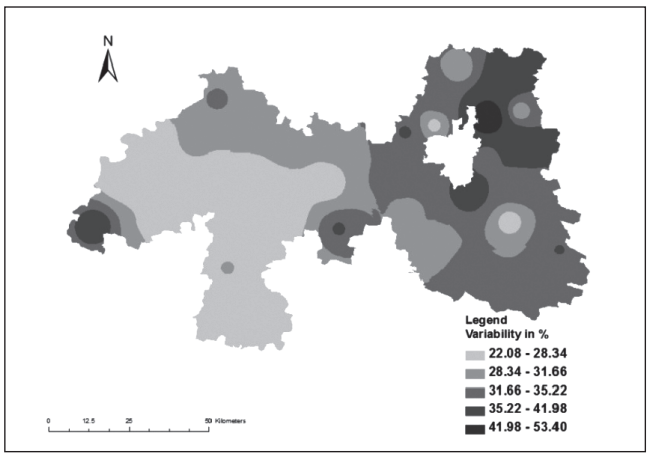

Fig. 4 : Annual rainfall variability

rainfall variability recorded at Manchal is 136.87% and maximum rainfall variability recorded at gandeed which is 258.93% The high variability in winter season of among all season states that the occurrence of less rainfall during winter. The seasonal variability shown in Fig 5a**.**

Summer season rainfall variability

The rainfall variability of hot summer is less than winter season. The variability during this season ranges between 59.78% to 149.72%.The maximum rainfall variability is recorded at Gandeed which is 149.70 % minimum recorded at Vikarabad which is 59.79% (Fig. 5b),

South West Monsoon rainfall variability

This season will have some variations in rainfall variability due to the influences of south west monsoon rainfall of India. Among the 37 stations the variability is relatively low. The maximum rainfall variability recorded at Malkajgiri which is 61.0% and minimum rainfall variability recorded at peddemel which is 25.84%. The variability of rainfall is good comparatively to the winter and summer season because of the rainfall during this season from the south west monsoon rainfall of India. The south west monsoon seasonal variability of rainfall shown in Fig 5c.

Northeast Monsoon rainfall variability

The north east monsoon rainfall variability experiences higher than the south west monsoon due to lesser rain, the maximum variability recorded at Gandeed which is 255.73% and lowest at Tandur which is 65.76%. This is the season gets more rain which is favorable for agricultural operation as the continuation of southwest monsoon rainfall. Summer rain is useful for preparation of land for agricultural activities and summer ploughing before sowing and seedling.. The North east monsoon seasonal variability of rainfall shown in Fig 5d.

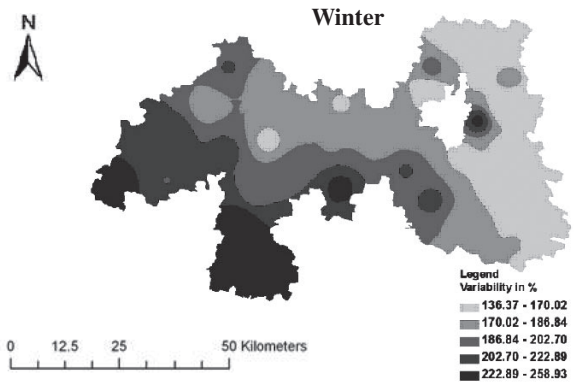

Fig. 5a: Winter season rainfall variability

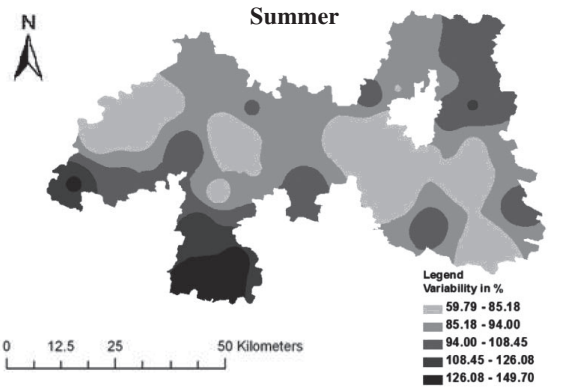

Fig 5b: Summer season rainfall variability

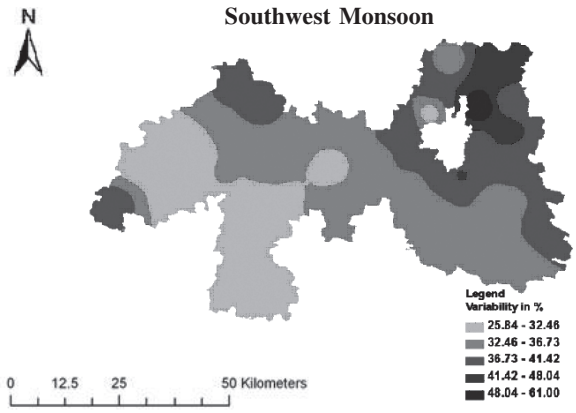

Fig 5c: Southwest Monsoon rainfall variability

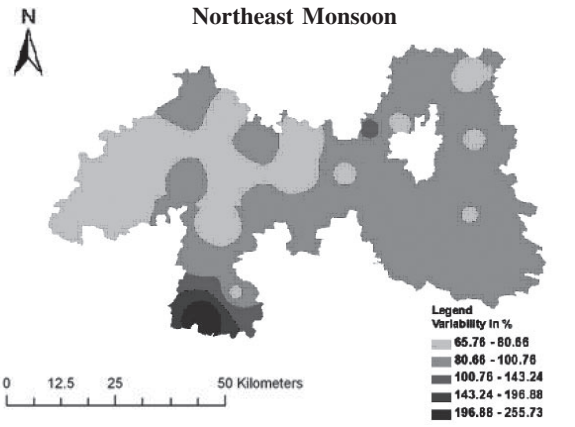

Fig 5d: Northeast Monsoon rainfall variability

Fig. (5 a to d) : Seasonal rainfall variability

CONCLUSIONS

The present study reveals the use of GIS in spatial analysis for rainfall variations to assess the rainfall trends and its variability. The study concluded that geospatial techniques are powerful tools that should be explored further for realistic assessment of the effects of climate variability on farming activities.

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