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FREQUENCY ANALYSIS OF RAINFALL DATA OF SAGAR DISTRICT

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Abstract: The present study concluded that the data of 29 years obtained from Water Resource Department is sufficient to obtain one to five consecutive days' annual maximum rainfall and average monthly rainfall. The data were analyzed for fitting one to five consecutive days' annual maximum rainfall and average monthly rainfall at different ability levels through various theoretical distributions; Normal, Log Normal, Gumbel and Log Pearson type III .The most suitable probability function to represent the observed data may depend on rainfall pattern of the place. As the rainfall pattern varies place to place the most suitable distribution may also vary from place to place. From the present rainfall analysis of the study area, the following conclusions are The maximum rainfall at sagar district of Madhya Pradesh state was 81.6mm, 208mm, 281mm, 304mm, 348mm and 46.712mm for one, two, three, four, five consecutive days annual maximum rainfall and average monthly rainfall respectively.

Index Terms - **Water Resource, Normal, Log Normal, rainfall analysis, consecutive, pattern.**

I. INTRODUCTION

Rainfall is the important physical phenomenon that transports the water from the atmosphere back to the earth's surface and connects the weather. Climate and hydrological cycle throughout the globe. Agriculture, food , security, and economy of india directly or indirectly vary on the timely accessibility of adequate quantity of rainfall and suitable climate.

In India, after independence due to population explosion and demand of more food production and irrigation development. 70% of the irrigated area of the country is under rainfed agriculture. Average annual rainfall of the country is about 1200mm and 80% of this occuronly in monsoon season. Indian economy has been traditionally dependent on agriculture. Some part of the country remains flooded every year, while there is no rainfall on the other part.

Most of the rainfall in india take place under the influence of south west monsoon between june to September. The rainfall in india shows great variations, unequal seasonal distribution, still more unequal geographical distribution and the frequent departures from the normal. It generally exceeds 1000 mm in area to the east of longitude 78 degree east. It extends to 2500 mm along almost the entire west coast and western ghats and over most of assam and sub-himalayan west Bengal. The estimate of aerial average rainfall is subjective depending on the method adopted. Therefore, estimates of local all over the country obtained by employing other techniques may differ, especially in a vast country like India. efficient utilization of rainfall may increase the agriculture production in many fields. Through the nature of the rainfall is erratic and various with time and space, yet it is possible to predict design rainfall fairly accurately for certain return periods using various probability distribution functions**.**

Probability analysis can be used for prediction of occurence of future events from available records of rainfall with the help of statistical methods. Based on theoretical probability distributions, it would be possible to forecast the rainfall of various magnitudes of different return periods. analysis of consecutive days and monthly return period is the basic tools for safe and

economic planning and design of structural and non-structural measures, small and medium hydraulic structure such as small dams, bridges, culverts, spillways, check dams, ponds, irrigation and drainage work in the watershed.

Sagar district is located in the north central part of the state of Madhya Pradesh and occupies as area of 10252 sq km. The district extends between the latitude of 230 10' and 240 27' north, longitude of 780 04' and 790 21'east. The district is bound in the north by state of Uttar Pradesh, in the north east by Chhatarpur district in south and west by Raisen, in the south east by Narsimhapur district, in the northwest by Guna district and in the east by Damoh district (fig 1). The National highway No. 26 passes through Sagar town. The district falls in survey of India toposheet No. 55M, 54L and 54P. Drainage The southern most tip of the district is drained by the Narmada river. However the major part of the area fall in the Ganga basin. The drainage of the district is towards north and north east. The five rivers, from west to east are the Bina, the Dhasan, the Bewas, the Sonar and the Bamner. The Bina takes its course upto several Kilometer to the south of the district and enters it near village Mahura. After flowing through Rahatgarh, the river takes a north easterly course and at places forms the boundary with Vidisha district. The Dhasan emerges from just south of the district and flows initially in the south and then to the north. It also forms the boundary with Jhansi district of Uttar Pradesh. The Kopra and Bewas are tributaries of the Sonar. The Sonar joins Bamber and then both river joins Ken river. The Ken is a tributary of the Yamuna river. The drainage pattern is of dendritic type. At a few place especially around Sagar town and near Khimlasa and Jaisinagar radial drainage pattern is also observed.

II.REVIEW OF LITERATURE

Ray et al. (1980)analyzed the 70 years (1901-1970) rainfall data of Gopalpur located in a district of Ganjam (Orissa). He has been used Weibull's method of frequency analysis for predicting rainfall amount on weekly amount at three levels of probability. At 50 % rainfall probability the crop planner may grow crop taking risk, where there was another 50% chance of crop failure. similarly for rainfall chance of crop failure in out of ten event.

Ajula and Ajula (1985) analysed the 24 years rainfall data (1960–1983) for the Ludhiana region, only four months Jun to Sep were considered the wet days the day for which the rainfall was less than 0.75 cm was considered as dry days

Oosterbaan, R.J. (1986) reported that the monthly maximum 1 - day rainfalls were used to derive the lognormal, the Gumbel, and the exponential frequency distributions, along with their confidence intervals that the data, all of which were plotted with the ranking method,do not lie on the straight lines calculated with the parametric estimates of the frequency distributions.

Agarwal et al. (1988)analyzed rainfall data for 60 years of six hill districts a U.PHimalyan (Almora, Chamoli, Dehradun, Garhwal, Pithoragarh and Nainital.) .The three probability distribution function which were widely used in hydrology as Gumbel distribution, Log Normal distribution and Log Pearson type III distribution have been compared with observed data. they reported that Log Pearson's type III distribution gap the closest fit to the observed data for annual maximum daily rainfall .

Upadhayaya and Singh (1998) reported that efforts have been made to correlate one day maximum rainfall of various return periods to consecutive days maximum rainfall of the same return period analysis showed that 2 -6 consecutive days maximum rainfall of 2 - 20 days return periods at Bhubneshwar can be predicted with the help of one day maximum rainfall with the same return period and percentage error in the predicted rainfall was less than 1 %.

Mohanty et. al., (1999) reported that annual daily rainfall data for 30 years (1995–1996) of Amravati analysis and frequency analysis had been done. The rainfall data had been distributed to four different probability distribution function i.e., Normal. Log Normal extreme value type 1 and Log Pearson type III distribution and probable rainfall values or different return periods had been estimated these values had been compared with the values obtainedby Weibull's method. The analysis indicates that the Log Pearson type Ill distribution gives the closest fit to the observed data

Singh (2001) analysed 19 years (1979–1997) annual maximum daily rainfall data for Eastern Himalaya (Sikkim mid hills) and the frequency analysis was done by using Log Normal. Log Pearson type III and Gumbel probability distribution for different occurrence interval .The analysis indicates that Log Normal gives the best fit for Eastern Himalaya .

George and Kolappadan (2002) analysed 16 years rainfall data of Periyar basin in Kerala. they found that the statistical composition by Chi - square test of goodness of fit clearly showed that Log Pearson type III distribution was best in predicting one day maximum rainfall for the areas Having similar rainfall pattern. the maximum daily rainfall was predicted directly from the frequency curve for hydrological uses.

Lee, C Y (2005) stated that Log Pearson type III distribution perform the best in probability distribution.Occupying 50% of the total station number

Sharda et.al. (2008) stated that annual extreme daily rainfall was estimated for 5-, 10 15- 20- 25- and 30 - year return periods using the best - fit two - parameter probability distributions log - normal and log - logistic distributions was found to be the best - fit for annual extreme daily rainfall data of Sahastradhara for different stations. The region was found to be homogeneous. The best - fit distribution used to compute annual extreme daily rainfall values was an essential pre - requisite for designing soil and water conservation structures economically and efficiently.

III.MATERIAL AND METHODS

The probability analysis of annual maximum daily rainfall for different return periods has been suggested for the design of small and medium hydraulic structures, The primary need of water resource development in any area depends on the estimation of rainfall at different probabilities for efficient planning and design of irrigation and drainage Systems, command area development. soil and water conservation program and the optimum utilization of water resources in various agricultural production systems. Must of the watershed planning activities include the designed of water storage structures and erosion control structures and efficient utilization of runoff for irrigation of different crops. Hence the analysis of rainfall at different durations like one, two three, four. five consecutive days and monthly rainfall is important for better planning and management of water resource. In this chapter various materials and methodology adopted in conducting the study

IV.RAINFALL AND CLIMATE

The climate of Sagar district can be classified mainly into three season. Winter season starts from middle of November to end of February. March to May constitute summer season and the monsoon season starts from second week of June to end of September. There are six rain gauge stations in Sagar district. Maximum rainfall occurs along the south western boundary of the district and decreases towards the north and slightly towards the east. In the southwestern parts of the district, Rehli gets a marked amount of low rainfall mainly due to its location in the valley on the leeward side of the hill range. The normal annual rainfall of the district is 1197.6 mm. About 90% of the annual rainfall takes place during the southwest monsoon period i.e. June to September only 5.5% of annual rainfall takes place during water and about 4.5% of rainfall occurs during the summer months. During winter season the January is the coldest months with the temperature falling as low as 11.60 g C and max up to 24.50 C. During the month of May, temperature goes up to 40.70 C (max.).

V.GEOMARPHOLOGY AND SOIL TYPE

Sagar district lies at the north eastern edge of the Malwa plateau, which widens in the south and south west. It lies just north of the Narmada river and is separated from tis valley by a steep escarpment towards the south. The area is by and large cropped by the deccan trap lava flows whereas at places vindhayan sandstone also crops out. The average elevation of the district is about 452 to 533 mamsl. It ranges from 353 mamsl in the Dhasan river bed in the north to 683 mamsl at Naharmau peak in the southwest. The physical divisions of the district are represented by the basins of several rivers. The area in the north west falling under Khurai tehsil is almost a level tract with an elevation of about 411 to 427 mamsl and is drained towards north-west by Thimpa, Parasasi and Bina rivers. These rivers are tributaries of the Betwa river.

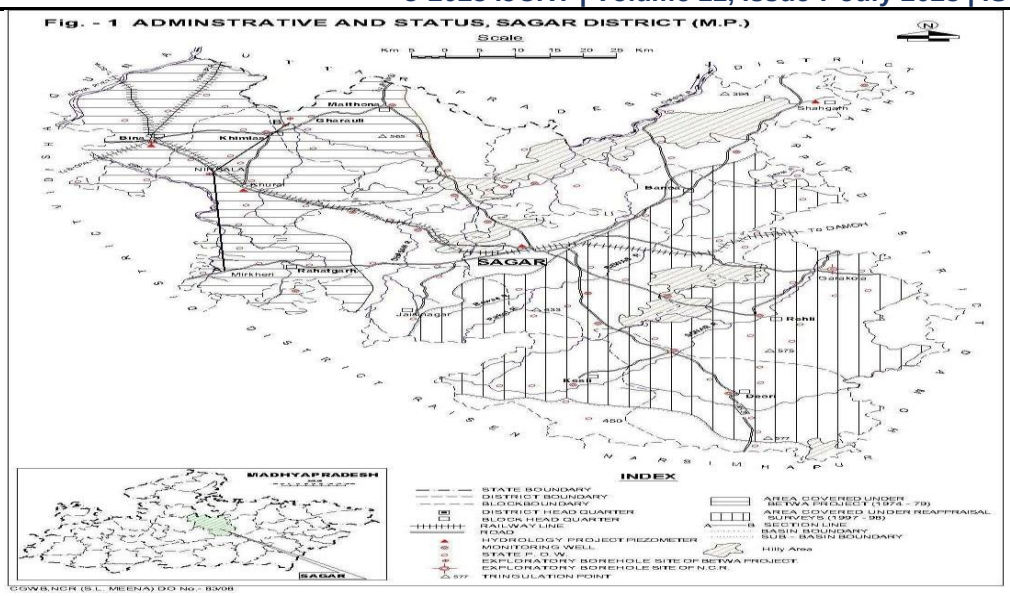

Fig-1 Adminstrative and status sagar district.

VI.CONCLUSION

- The maximum rainfall at sagar district of Madhya pradesh state was 81.6mm, 208mm, 281mm, 304mm, 348mm and 46.712mm for one, two, three, four, five consecutive days annual maximum rainfall and average monthly rainfall respectively.
- The statistical comparison at 6.6%, 10%, 20%, 40%, 50% by Chi- square test for goodness of fit .lt clearly indicates that Gumbel distribution was very near to the observed rainfall for one day annual maximum rainfall (mm).
- Log Pearson type IlI. distribution was found to be best model for predicting two. three and four consecutive days annual maximum rainfall(mm).
- Normal distribution wis found to be best model for predicting five consecutive days annual maximum rainfall and average monthly rainfall .

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