

OCCURRENCE OF HEAVY RAIN EPISODES OVER MADRAS

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ABSTRACT

Heavy rain episodes over a place paralyses life and activities, especially in the metropolitan cities. Hence the detailed informations on heavy rain episodes over a location will be of immense help to various agencies. The heavy rain episodes (24 hourly rainfall  $\geq 7$  cm) during 1967-86 (77 in number) over Madras (Meenambakkam) have been examined and the results are presented.

While 78% of heavy rain episodes occur during the Northeast Monsoon months of October to December, the month of March, April and June are free from heavy rain episodes. Only in less than half the number of occasions (44%) the heavy rain occurrences are associated with clear-cut synoptic systems like depressions and cyclones. Episodes of heavy rain greater than 15 cms. form only 16% of total heavy rain occasions. Late night appears to be the preferred period of high intensity rainfall in about 26% of occasions. The chance of northeast monsoon rainfall being normal or above normal is good when at least four episodes of heavy rain occur over Madras during this period. The duration, number of spells and association with rainfall activity over rest Tamilnadu have also been discussed.

1. Introduction:

A detailed study of precipitation characteristics over a location is of great importance in hydrology. For a metropolitan city a knowledge of heavy precipitation characteristics is helpful for development and proper design of drainage and road system of the city. Water management to various needs can be made more effective with a knowledge of the characteristics. A study of heavy precipitation over Madras (Meenambakkam) was attempted towards this direction and the results are present here.

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Madras the capital city of Tamilnadu is located at  $13^{\circ}00' N$  and  $80^{\circ}11' E$ . The annual rainfall of this coastal city is 132 cms. and about 60% of the annual rainfall occurs during the northeast Monsoon months of October to December. Detailed study of intensity of rainfall at Madras was made by Krishnaswamy (1952). Ramakrishnan (1953) studied fifty years of rainfall of Madras city. Exceptionally heavy rainfall phenomenon at Madras in Feb. 1984 was studied by Bhaskara Rao et al (1986). Recently the rainfall rates over Madras have been found to obey an exponential law (Sivaramakrishnan and Sridharan 1987 a). Annual rainfall tendency over the years at Madras been investigated by Sivaramakrishnan (1983), (1987 b). Here an attempt has been made to study the occurrence of heavy rainfall at Madras (Meenambakkam) in relation to the preferred period of occurrence, the duration, number of spells contributing to it and its association with rainfall distribution over rest Tamilnadu. Heavy rainfall here refers to rainfall  $\geq 7$  cm. during the 24 hours ending at 0830 hours I.S.T. The synoptic situations favourable for their occurrence have also been discussed.

## 2. Data and methodology

The rainfall figures for the years 1967-86 for Madras (Meenambakkam) were examined and about 77 heavy rain episodes occurred during this period. The self recording rain gauge (SR RG) charts for these 77 occasions were examined to identify the period of maximum intensity of rainfall, duration and number of spells contributing to heavy rain in each case. The rainfall values of Madras (Nungambakkam) were also scrutinised on those days when heavy rain was reported at Meenambakkam. The rainfall distribution over rest Tamilnadu was worked out based on rainfall figures received throughout the year from about 40 rainfall reporting stations in Tamilnadu.

## 3. Results and discussion

Fig. 1 gives the percentage frequency of occurrence of heavy rainfall for each of the month. It can be seen that maximum frequency of occurrence of heavy rain is in the month of November (35%) closely followed by October (31%). Northeast Monsoon months of October to December contribute nearly 78% occasions. It can also be seen that March, April and June are devoid of any heavy rain episode during the period under study. The rainfall amount was divided in class intervals of 3 cms. from 7 cms. onwards and the frequency distribution of heavy rain episodes giving the rainfall is presented in Fig. 2. Rainfall  $\geq 22$  cms. has been taken as single

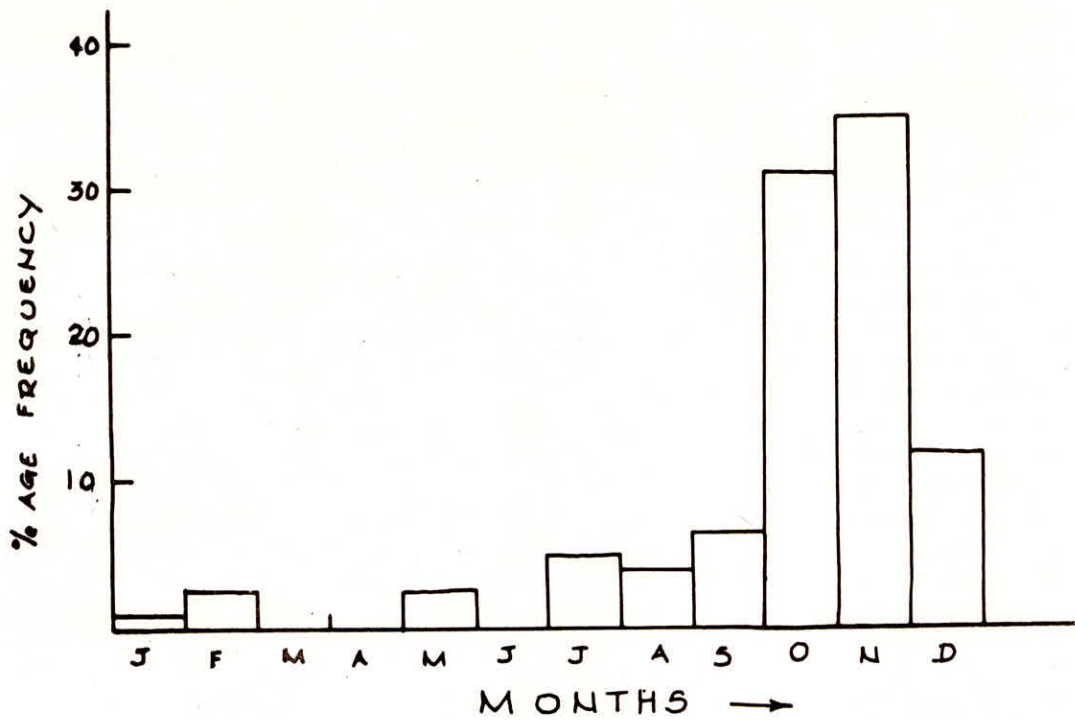


FIG.1-DISTRIBUTION OF HEAVY RAIN EPISODE IN DIFFERENT MONTHS

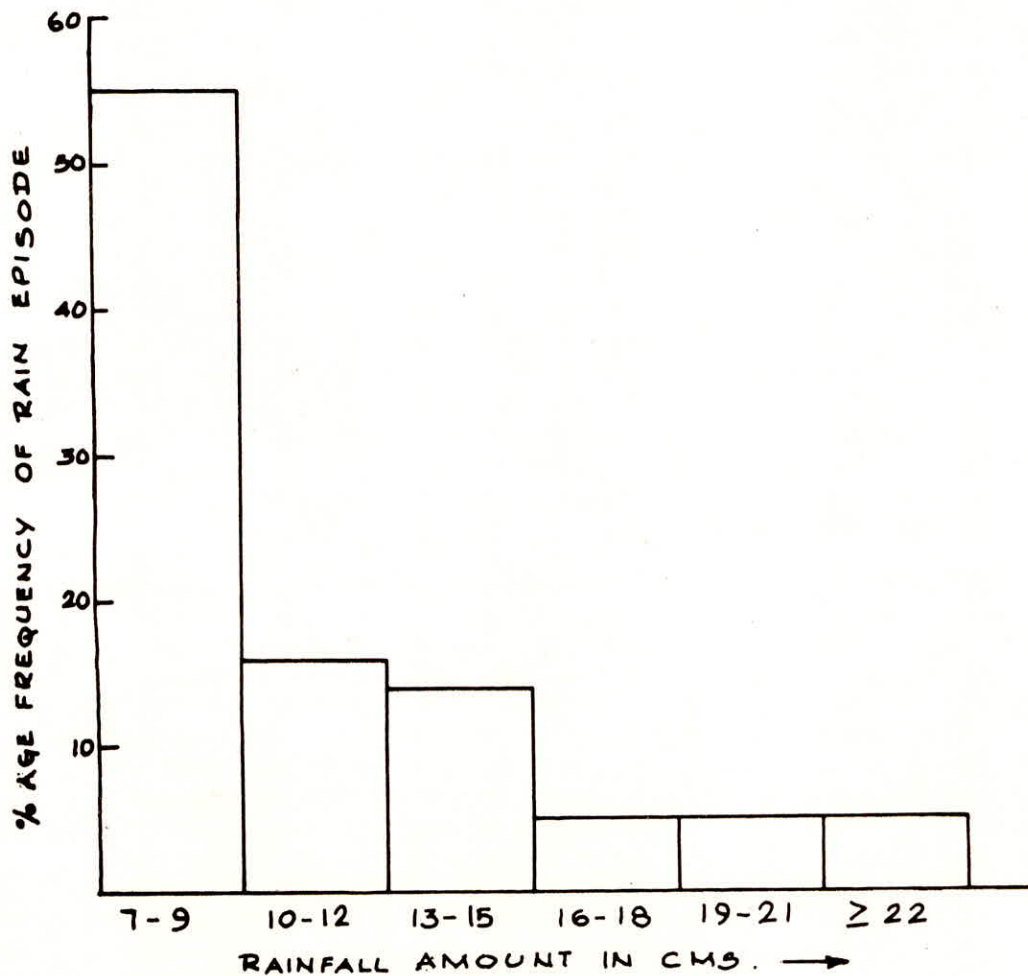


FIG2.-RAIN AMOUNT VERSUS FREQUENCY



interval for convenience. It can be inferred that among heavy rain episodes the rainfall in the range of 7 - 9 cm. account for nearly 55% of occasions. Heavy rainfall greater than 15 cm. form only about 16% of occasions. Exceptionally heavy rain of 35 cm. was recorded on 25th Nov. 1975

Duration of heavy rainfall episodes at an interval of 2 hours upto 12 hours and  $> 12$  hours were then plotted against their percentage frequency. Fig. 3 gives this result. It is evident that heavy rain in 38% of occasions is the result of rainfall occurring for more than 12 hours. However, in about 18% occasion heavy rain has occurred in 4 - 6 hours. This is of importance to drainage engineers. Fig. 4 shows the plot of number of rain spells contributing to heavy rain against their frequency of occurrence. It is easy to see that single spell has contributed to heavy rain in about 49% of occasions. 3 spells contribute in about 22% of occasions. Occasions of 5 spells or more is very rare. A day was then divided into 6 equal intervals of 4 hours each starting from 00 hours. Fig. 5 shows the percentage frequency of occurrence of maximum intensity during various intervals. It is seen that late night hours i.e. 00 - 04 hours is the preferred period of maximum intensity of rainfall (26%). Next preferred period of 08-12 hours and 12-16 hrs. have a frequency of about 19% each.

The study further indicated that in about 88% of occasions heavy rain at Madras (Meenambakkam) was associated with at least scattered rainfall in rest Tamilnadu. In only 3 cases heavy rainfall was associated with onset of northeast Monsoon. It was also seen that in about 60% of occasions heavy rain at Meenambakkam was associated with heavy rain at Nungambakkam as well. It has also been found by the study that if there are at least 4 occasions of heavy rain in the northeast Monsoon period there is a fair chance of seasonal rainfall being normal or above normal at Madras. However, no link could be established between the occurrence of heavy rain episode during northeast Monsoon period and the occurrence during rest period of the year.

During the northeast Monsoon months of October to December the heavy rain at Madras is associated with depressions/cyclonic storms or seasonal trough/low getting well established. During the month of May cyclonic storms are found to cause heavy rain at Madras. During the southwest Monsoon months of July to September prevalence of clear-cut trough line from South Tamilnadu to North Andhra coast via North Coastal Tamilnadu is found to be favourable synoptic situation for heavy rain. Weak or break monsoon conditions over the country has caused heavy rain at Madras only on one occasion.

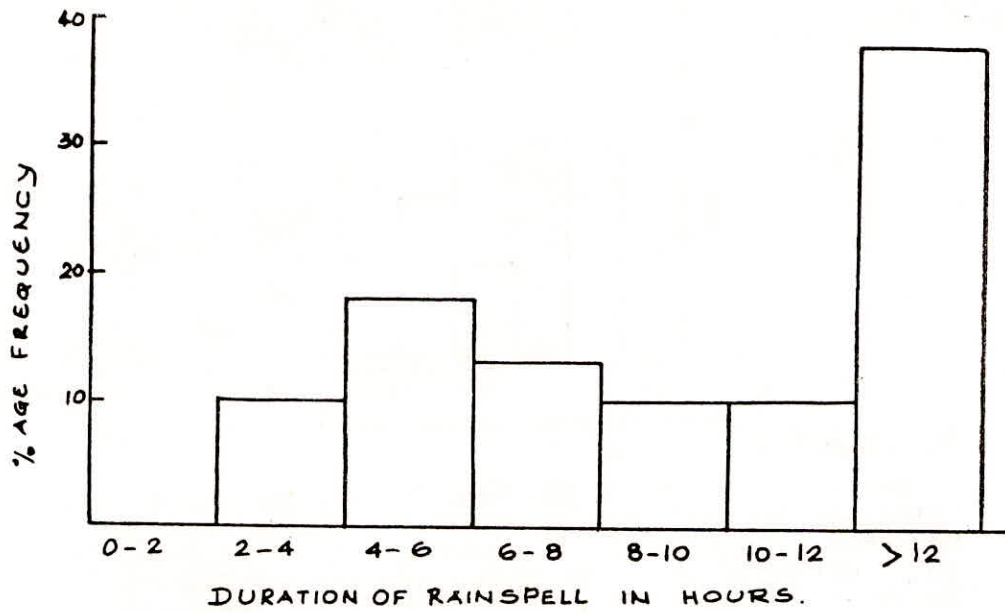


FIG.3-DURATION OF RAINSPELL ASSOCIATED WITH HEAVY RAIN

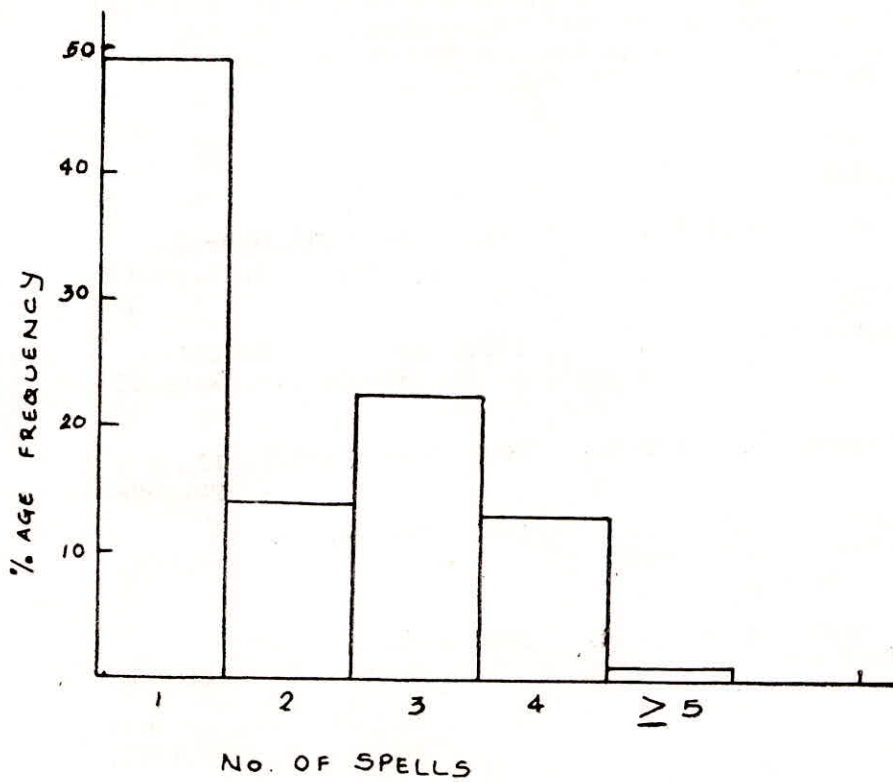
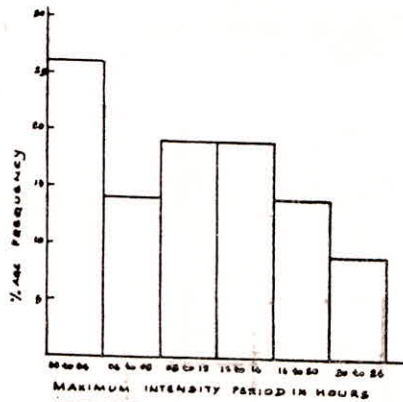


FIG.4-NUMBER OF SPELLS CONTRIBUTING TO HEAVY RAINFALL



FIGS.-OCCURRENCE OF MAXIMUM INTENSITY DURING DIFFERENT PARTS OF THE DAY

#### 4. Conclusion

The study has shown that heavy rain occurs at Madras mainly during the northeast monsoon period of Oct. to December. Late night i.e. 00 - 04 hours is found to be preferred period of high intensity rainfall. Episodes of heavy rain greater than 15 cm. form only 16% of occasions. In about 88% of occasions heavy rain at Madras was associated with at least scattered rain all in rest Tamilnadu. There is a fair chance of Northeast monsoon rainfall being normal or above normal if there are at least 4 heavy rain episodes over Madras during this period.

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