STUDY OF LONG DURATION RAINFALL DATA FOR THE NORTH-WEST REGION OF BANGLADESH

A Thesis
by
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WE HEREBY RECOMMEND THAT THE THESIS PREPARED BY TARIQ AHMED ENTITLED STUDY OF LONG DURATION RAINFALL DATA FOR THE NORTH-WEST REGION OF BANGLADESH BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ENGINEERING (WATER RESOURCES).

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ABSTRACT

This thesis deals with the analysis of long duration extreme value rainfall data for the north-western region of Bangladesh. Maximum 1,2,3,5,7,10 and 15 day rainfall data for the district (old) of Dinajpur, Rangpur, Rajshahi, Bogra and Pabna have been analysed and discussed in this thesis. Gamma and Gumbel distributions were tested to select a suitable distribution for the analysis. The tests indicated that the Gumbel distribution is the better choice . Rainfall data of different duration corresponding to different return periods have been calculated by the Gumbel distribution.

Rainfall depth-duration-frequency nomograph for the whole region have been prepared. Correction factor table and charts have been prepared to get point rainfall from the generalized nomograph. Generalized isohyetal maps of different duration and having 2-year return period have also been prepared and presented for the study area. Empirical equations for the whole north-west region as well as for different hydrological units proposed by the Master Plan Organization (MPO) have been developed to calculate the rainfall of different duration from the 2-year value.

Probable maximum precipitation (PMP) of different duration have been calculated by using Hershfield's revised approach for each of the 55 selected stations within the study region. A simplified method has been proposed to obtain the PMP of any duration using Gumbel distribution results.

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NOTATIONS

I	- Rainfall intensity, mm/hr.
t	- Duration of Rainfall in hours.
X_M	- Magnitude of PMP for a particular duration.
$\bar{X}_N$	- Adjusted Mean of the Annual Series.
$\bar{S}_N$	- Adjusted s.d. of the Annual Series.
K_M	- Frequency factor.
N	- Sample size.
P	- Probability distribution function (p.d.f.).
y	- Reduced variate.
x	- Initial variate.
U	- Location parameter.
β	- Scale parameter.
S	- Standard deviation of the Sample.
T	- Return Period in years.
X_T	- Rainfall magnitude for return period T years.
γ_1	- Skewness co-efficient.
γ_2	- Kurtosis.
α	- Shape parameter.
μ	- Mean of the sample.
$\bar{y}_N$	- Theoretical quantity.
σ_N	- Theoretical quantity.
k	- no. of class intervals.
O_i	- Observed frequency.
E_i	- Expected frequency.

$S_n(x)$ - Sample c.d.f.

D - Maximum deviation.

$\overline{X}_{N-1}$ - Mean of the series omitting the highest value.

$\overline{S}_{N-1}$ - S.D. of the series omitting the highest value.

$P_T^{N\text{-}DAY}$ - Maximum N-day rainfall for T year return period.

$X_{100}^{N\text{-}DAY}$ - Rainfall magnitude having 100 year return period.

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CHAPTER I

INTRODUCTION

1.1 General

The frequency of high-intensity rainfalls are required for several engineering purposes, one of the most important being the estimation of various streamflow characteristics for inadequately gaged streams. In general, the rainfall associated with the extreme floods of large streams is of relative long duration while the rainfall associated with the floods of smaller streams is of shorter duration. Rainfall based techniques are considered the second-best [18] to the direct analysis of adequate streamflow data. Because rainfall data are generally more widely available than streamflow data the concept of using rainfall data to estimate various streamflow characteristics is well established.

Rainfall intensities are also required to determine the size of hydraulic structures regulating the flows in the watersheds. In situations where the risk of the structure's failure must be minimized, the probable maximum precipitation (PMP) is considered for determining the size of the structure. Information on rainfall data is also important in various types of hydrologic studies such as (1) Storm analysis over a catchment; (2) Depth-area-duration studies ; (3) Intensity-duration-frequency analysis; (4) Probability analysis to determine the supplimentary irrigation potentialities etc.

With longer concentration periods encountered in drainage problems, the need of more complete knowledge of rainfall intensities for duration longer than 120 minutes arises. Longer duration storm periods are generally intense downpours, separated by intervals of light or of no rainfall. In the case of sewers, each storm phase may be considered as an individual occurance Concentration periods are usually less than two hours, and the drainage system has the opportunity to clear itself before the next period of intense rainfall. The higher degree of saturation throughout the next storm period is the only factor to be considered. This condition does not prevail in the larger, more pervious watersheds. The characteristics of such watersheds are

- slow movement of runoff over the ground, through furrows and unimproved drains.
- greater effect of retention and retardation.
- lower velocities through the drains.

Due to these reasons it requires longer time of flow through the drains and therefore, for the design of drainage systems, storm periods from 1 to 10 days should be considered. A knowledge of the frequency with which a rainfall intensity of a given duration will be equalled or exceeded in a locality is essential to the intelligent design of the drainage system.

The need for representative estimates of rainfall on a weekly of fortnightly basis is greatly felt in connection with the agricultural operation, crop planning and to some extent for planning of irrigation schedules and also to draw detailed development plans in the field of water resources and agriculture.

Pharande and Dastane [26] listed the following salient points on the importance of rainfall data in the field of agriculture.

- designing irrigation projects on a sound economic basis;

-fixing cropping patterns and working out the irrigation requirment of crops;

- operating irrigation projects efficiently from year to year;

- preparing schedules for other farm operations in irrigated agriculture;

- planning cropping pattern in unirrigated or rainfed areas;

- designing drainage and land reclamation projects;

- planning soil and water conservation programmes;

- interpreting field experiments accurately;

- classifying regions climatologically for agriculture.

There are two principal approaches of estimating the magnitude of the rainfall that are desirable from the designer's viewpoint. The first is the probable maximum precipitation procedure (PMP), which builds up a design storm from detailed studies of large storms, and the second is the statistical approach whereby estimates are derived from the analysis of individual and cumulative aggregate storm data. The object of the former is to provide the hydrologist with complete-safety criteria in situations in which extreme loss of life and property would result from failure or overtopping of a structure.

In small agricultural watersheds, designs are not made to provide for a PMP storm, because there would be little hazard downstream from a structural failure. Instead, a frequency approach is used, whereby the extreme rainfall at a particular point or area are analysed statistically to determine the frequency with which a given intensity of rainfall can be expected to occur. This information is of particular value in reaching a decision concerning acceptable calculated risks for design criteria.

Generally the information on rainfall may be presented in many ways. For quick reference most countries have equal rainfall maps (isohyetal maps) for different durations. For given locations prediction formulae or graphs are also available. The local historical data, when analysed and plotted gives yield versus return-period data for various durations, either in graphical form or as a prediction formula.

1.2 Objective of the Study

A review of partinent literature shows that all the rainfall analysis in our country have been directed toward the agricultural potentialities. Recently Matin [20] studied the rainfall data of north-east region of Bangladesh and calculated one day PMP of all the rainfall stations of the region. A generalized intensity-duration-frequency curve of the region was also developed. However, his study was limited to only short duration rainfall intensity,e.g., 5 min.,10 min., 15 min etc. Virtually no attempt has so far been made to generalize the long-duration cumulative rainfall in Bangladesh. Though in the case of hydraulic structures cent per cent safety is not required and the design is usually based upon maximum cumulative rainfall (lasting several days) corresponding to a certain return period. Therefore, the followings were chosen as the principal objectives of this study over the north-western region of Bangladesh comprising the districts (old) of Rajshahi, Dinajpur, Rangpur, Bogra, and Pabna.

1) Selection of a suitable distribution for analysing annual extreme cumulative rainfall series having different durations.

2) Preparation of a generalized depth-duration-frequency relationship for the whole region under study.

3) Preparation of isohyetal maps for different durations.

4) Development of an empirical relationship to determine the probable maximum precipitation from the statistical analysis.

1.3 Statement of the problem

Selection of probability distribution: Various theoretical and empirical distributions have been proposed as being generally applicable to the analysis of rainfall data but none has been found to be universally acceptable. The following frequency distribution have been found to be the most consistant ones. [15,17,20] .

- Gamma distribution and
- Gumbel distribution.

Therefore the work has been divided into the following phases:

1) These two distributions have been compared for their ability to fit the maximum rainfall values (of different durations) in the region. Among them, the best fitted distribution has been selected for further study for the region.

2) Using the selected distribution, estimates of

rainfall depth for six different recurrence intervals from 2 to 100 years have been made for seven different durations from 1 to 15 days.

2) Attempts have been made to prepare generalized depth-duration-frequency relationships of the region which may be represented by equations , isohyetal maps or nomographs.

4) Attempts have also been made to develop enveloping curves and empirical methods for quick estimation of probable maximum rainfall (PMP).

All the data analysed in this study were obtained from Bangladesh Water Development Board (BWDB). It is expected that this study will be of great help for the engineers working with different water resources projects.

CHAPTER II

REVIEW OF LITERATURE

2.1 A review on comparison of some methods of probability distribution

The selection of proper extreme-value procedure, which includes both probability distribution and curve fitting methods is one of the major problem encountered in the analysis of extreme value rainfalls. This subject has been treated in details in related literature [16,9,14,15,26,23], but as yet there is not a complete consensus among the analysts as to the relative merits of the different procedure.

In 1959, Huff and Neill [16] compared five distributions for their ability to estimate the largest rainfall value in Illinois. The distribution included Gumbel (extreme-value distribution-I), Lognormal, Frechet, Log skew and Jekinson method. Analysis were performed on both seasonal and annual maxima for storm periods of one to ten days. Calendar-day rainfall amounts from 39 stations for the 40 year period, (1916-1955), provided the basic data for the study. Statistical tests indicated no marked superiority of any one of the distributions. Comparisons were made between results obtained from the method of moments and least squares. It was concluded that differences obtained between the two methods are insignificant.

Hershfield [9] compared three distributions to estimate the largest rainfall value. Several thousand station years of rainfall data from many stations were fitted to the three commonly used extreme-value procedures : lognormal distribution fitted by the method of moments and the Fisher Tippet type I distribution fitted by both the Gumbel and Lieblein methods. The Gumbel procedure was found to be the best of the three for estimating the probabilities of extreme rainfalls. The Lognormal and Lieblein procedures give nearly identical return period estimates and provide a closer fit to the developmental data than the Gumbel procedure. The average difference in magnitude between the 100-year value from the lognormal and Lieblein procedure on the one hand and the Gumbel procedure on the other was approximately 10 percent and the Gumbel was always larger. It was found that the Gamma distribution provides an acceptable fit to rainfall extremes, but, in general seriously underestimates the longer return period value.

Gupta, Tiwari and Narayan [25] studied the rainfall data of Karnal for the determination of runoff potential of the storms. Frequency analysis of 25 years of daily rainfall data has been attempted by applying (a) Type I extremal probability distribution (b) Lognormal distribution and (c) Pearson's Type III, logarithmic distribution. They concluded that in the range of 2-10 years return period which is important for agricultural purposes the variation among the methods was only 4 per cent. As these values fitted the observed data well, any of the four methods could be adopted depending upon the convenience.

In 1978, Dhar, Rakhecha and Mandal [28] studied the rainfall data of various durations (1, 2 and 3 days) of three river basins in the North Indian plains. They employed the Gumbel frequency analysis as modified by Chow (1964) to determine the design rain depths for different return periods.

Hounam [15] stated that the actual extreme rainfalls are generally not normally distributed but in most cases the logarithms fit in a better way. However, in some climatic zones the distribution is more complex and the data may be fitted better by the Gumbel treatment of extremes. or the incomplete gamma function. The distribution finally accepted will have an influence on the extrapolated rainfall values.

In 1965, Hershfield [14] suggested that a combination of the Gumbel procedure and Fisher-Tippet Type I distribution is satisfactory for extreme rainfall data. If Gamma distribution is chosen, the method of moments may be used with reasonable results even though this method of fitting is not the most efficient.

2.2 Australian Study

In 1977, Institution of Engineers, Australia, published Australian Rainfall and Runoff [18]. In this study estimates of rainfall intensity for seven different recurrence intervals from 1 to 100 years have been made for 12 different durations between 6 minutes and 72 hours at different pluviographic stations of Australia. Smooth curves have been fitted to the sets of estimates for each of the seven recurrence intervals (2,5,10,20,50 and 100 years) and these form the basis of the rainfall-intensity data in the publication.

As presented by them, each rainfall intensity-frequency-duration curve can be represented by a polynomial equation of the form of Eq. (2.1), which has been derived using Australian data by the Bureau of Meteorology.

$$\ln I=a+b(\ln t)+c(\ln t)+d(\ln t)+e(\ln t)$$
$$+f(\ln t)+g(\ln t) \qquad (2.1)$$

where,

I = rainfall intensity in mm/h,

t = duration of rainfall in hours,

$a,b.....g$= co-efficients.

But Eq. (2.1) is not valid for less than 6 minutes or greater than 72 hours.

2.3 Bernard's Study

Bernard [4] proposed rainfall intensity formulas for return periods of 5,10,15,25,50 and 100 years, applicable to rainfall duration periods of 120 to 6000 minutes for the United States. Fig. 5 represents the depth-duration-frequency relationships of the eastern U.S. The work of Mayer [23] and Morgan [24] has been connected in this study. Mayer's purpose was the development of intensity formulas for heavy storms of short duration, while Morgan was interested in the longer storm periods of 1 to 6 days. Table 6 represents their rainfall depth and intensity formulas.

2.4 Mcculloch's and Booth's study

Mcculoch and Booth [22] studied the fortnightly precipitation data for the estimation of avarage monthly precipitation over Great Lakes in Canada. The study was based on the general regression model of 30 years' precipitation data of five stations. Verification on three years' test data showed a maximum cumulative annual error of 4% with individual monthly errors as high as 17%.

2.5 Determination of Probable Maximum Precipitation (PMP)

2.5.1 Traditional Approach

The traditional procedure used for estimating the probable maximum precipitation (PMP) uses a combination of a physical model and several estimated meteorological parameters. Unlike most investigations in which estimates can be compared with actual observations, the quality of the estimates obtained from the traditional approach cannot be evaluated. Hydro-meteorological report no. 33 [30], prepared on the basis of traditional approach, presents generalized charts and diagram giving PMP estimates for several combinations of areas and durations east of 105 degree west. In a paper [1] Ackermann questioned the degree of acceptance of the estimates derived from the traditional approach. Hershfield [14] reported that several studies using this approach have terminated with divergent results for the same area. World Meteorolocal Organization Guide to Hydro-meteorological practice [33] has recommended Hershfield technique which is applicable to point rainfall values for arriving at tentative estimates of PMP for which long term daily rainfall data for individual stations are available but where the adequate data for applying the traditional approach are lacking.

2.5.2 Hershfield's Study

Hershfield [12] proposed a method for systematic analysis of precipitation data with the goal of reducing the uncertainty surrounding the PMP estimates. The analysis presented in the paper are based on 24-hour rainfall from about 2600 stations with a total of 95000 station-year of data. A combination of several statistics from each station's data was computed and viewed in the aggregate in order to arrive at an enveloping statistic. Because reliability is a major design parameter, empirical measures of several components of sampling error have been determined for each statistic. Empirical adjustment factors have been derived for such data deficiencies as small sample size and calendar-day rainfall rather than the 1440-minute maximum rainfall.

Hershfield proposed the following empirical equation for computing the PMP of any area of the world.

$$X_M = \overline{X}_N + K_M * \overline{S}_N \qquad (2.2)$$

where,

X_M = magnitude of PMP of a given station for a particular duration,

$\overline{X}_N$ = adjusted mean of the annual series and

$\overline{S}_N$ = adjusted standard deviation of the annual series.

The value of K_M in the above equation is obtained from the following equation

$$K_M = \frac{X_{MAX.} - \overline{X}_{N-1}}{\overline{S}_{N-1}} \qquad (2.3)$$

where the mean $\overline{X}_{N-1}$ and $\overline{S}_{N-1}$ are obtained by omitting the maximum observed rainfall from the computation.

Using the above procedure Hershfield calculated the value of K_M and proposed the following equation for 24-hour rainfall.

$$X_M = \overline{X}_N + \overline{S}_N * 15 \qquad (2.4)$$

In 1965, Hershfield made an extension and revision of parer [14] in which a large number of 24 hour rainfall data had been studied. He considered the series of annual maximum rainfall for different durations ranging from 5-min. to 24-hour. Plotting of the value of K_M against the mean for different duration, he obtained a family of curves as shown in Fig. 6. These curve show that K_M is a function of storm duration and mean of annual series and has a tendency to decrease with increase of rainfall magnitude of different duration.

Use of regional envelope value of K_M

Wilson [34], Mazumdar and Rangarazan [29] reviewed the idea of Hershfield and found that, PMP values using Eq. (2.4) overestimated the precipitation data for some region. They, therefore, pointed out that the one single value of K_M is not transposable universally throughout the world. In a study of rainfall over Uttar Pradesh in India, Dhar and Kamte [8] found that the highest value of K_M for 24-hour duration was 12. In 1978 Changrancy and Hem Raj [5] used Hershfield's technique for estimating PMP for Madhya Pradesh region in India and reported that the value of K_M were generally higher for areas of relatively higher monsoon rainfall or of higher magnitude of one day maximum rainfall. They, therefore, modified the Hershfield's equation using the enveloping value of K_M applicable to Madhya Pradesh in the form of

$$X_M = \overline{X}_N + 7 * \overline{S}_N \tag{2.5}$$

It is therefore advisable to use regional envelope value of K_M instead of using world enveloping value.

2.6 Indian Study

In 1978, Dhar, Rakhecha and Mandal [28] studied the rainfall data of three river basins in the North Indian plains, viz, (1)the Subarnarekha, in the east, (2) the Betwa in the central part (3) the Mahi in the west, lying in the latitude belt of 21° N to 25° N. For each of the selected area PMP design storm values of 1,2 and 3 day duration were worked out and presented as percentage of mean annual rainfall as shown in Table 7.

2.7 Rainfall studies in Bangladesh

Manalo [21] carried out a detailed rainfall study of Bangladesh describing the characteristic features of the climatic regimes of the country for evaluating the potentialities of cropping system. The appendix of his report contain 11 tables dealing with monthly data from 120 raingauge stations in 19 hydrological districts of Bangladesh. The results of the analysis was presented in the form of isohyetal maps representing mean annual rainfall, mean monthly rainfall, mean seasonal rainfall, number of months with rainfall 100 mm. and 200 mm. months of start and end with rainfall 100 mm. and 200 mm. etc. To portray the succession of weather sequences during the year, Manalo prepared histograms of monthly rainfall (Fig. 4) over the stations. These graphs have little prognostic value for short period of one or two days but they tell us about the rainfall we should normally expect.

Khan [19] estimated rainfall probabilities for 2-week running period using daily rainfall data for 36 years of record (1934-69) from 13 different locations. His analysis is helpful for designing cropping pattern and supplementary irrigation system.

In 1972, IBRD [17] studied the rainfall data of nine rainfall stations of Bangladesh for the agricultural and drainage requirements. Probability analysis have been carried out to determine expected amounts of rainfall for weelkly, bi-weekly, tri-weekly and monthly totals using daily rainfall data for 36 years record (1934-69) for nine different locations namely : Barisal, Bogra, Chittagong, Comilla, Dhaka, Khulna, Mymensingh, Rangpur and Rajshahi. From these analysis, the probability occurrences of too little rainfall or too much rainfall and right amount of rainfall for crop growth in any week, 2-week and 3-week running period as well as in any month can be determined.

To determine the drainage requirements, maximum values of precipitation on 1,2,3,5,7,10 and 15 consecutive days have been computed for the months of May, June, July, August and September for each of the nine stations. Typical results of the analysis described above are shown in the Fig. 8 and 9.

The probabilities of heavy rainfall in Bangladesh was studied by BWDB and the UNDP [2]. The primary objective in their analysis of heavy rainfalls was to produce criteria for drainage design. It included rainfall duration from 1 to 6 days. The six day duration was chosen as the upper limit, as this is consistent with a critical period of inundation for the rice crop. The data source used was the daily rainfall data from the Bangladesh Meteorological Department climatic stations, as listed below.

Station	Length of record
Comilla	1947-79
Dhaka	1954-80
Mymensingh	1947-80
Srimangal	1947-70

Sylhet	1947 80
Bogra	1947-80
Dinajpur	1947-80
Rangpur	1947-80

For each year of record the annual maximum rainfall for 1 day was extracted and also the totals for the maximum consecutive 2 to 6 day periods. These were then ranked in descending order and assigned a probability plotting position according to Blom formula. The data were then plotted on logarithmic probability paper, and estimates abstracted for return periods of 5,10 and 20 years. These data for all durations were then combined to produce plots of depth versus duration using logarithmic graph paper with best fit lines fitted to each of the above frequencies. However, no regional generalization has been attempted in their study. A typical probability plot is presented in Fig. 10 and a family of curves for depth versus duration shown in Fig. 11.

Recently Matin [20] studied the extreme value rainfall data for the north eastern region of Bangladesh. PMP of 24 hour has been estimated for each station of the region using Hershfield's revised approach. Using Gumbel distribution, prediction equations for maximum daily rainfall for return periods of 2,5,10,20,50 and 100 year were developed. An empirical equation has been proposed to calculate the daily rainfall data for different return periods from the daily two year value. However, his study was limited to only short duration rainfall data i.e., from 5 min. to 1440 min.

CHAPTER III

THEORETICAL CONSIDERATION

3.1 Theories of Probability distribution function

The following probability distribution functions were considered for this study.

(1) Double Exponential Distribution Function,

(2) Gamma Distribution.

3.1.1 Double Exponential Distribution Function

The Double Exponential Distribution Function of the largest value in its cumulative form is defined as

$$p = F(X) = \exp\{-\exp(-y)\} \qquad (3.1)$$

and $$y = \frac{x - U}{\beta} \qquad (3.2)$$

where y is the dimensionless reduced variate, x is the initial variate, the quantity U is the mode or location parameter of the distribution and

β is the scale parameter which is analogous to the standard deviation , σ , of normal distribution. The parameter U and β completely define the distribution.

Combining the above two equations the distribution function may be written as

$$F(X) = \exp[-\exp(\frac{1}{\beta}(x-U))] \qquad (3.3)$$

This was introduced for extreme values by R.A. Fisher and I. H. Tippet [35]. This function is sometimes known in Hydrology as Gumbel Function because of Gumbel's various studies of distribution of extreme flood peak discharge.

3.1.1.1 Prediction equation for the Double Exponential Distribution Function

This involves the computation of the sample mean $\bar{X}_N$, and the standard deviation S_N, of the annual series of a sample of size N. The estimates of two parameters U and β are given by

$$U = \bar{X}_N - \frac{\bar{y}_N}{\sigma_N} * S_N \qquad (3.4)$$

$$\beta = \frac{S_N}{\sigma_N} \qquad (3.5)$$

where $\bar{y}_N$ and σ_N are the theoretical quantities which are functions of sample size only. Gumbel provides a table of values (Table - 3) for $\bar{y}_N$ and σ_N as function of sample size N. Therefore, prediction equation for rainfall magnitude (X_T) may be expressed by the following function

$$X_T = U - \ln[\ln(\frac{T}{T-1})] \qquad (3.6)$$

where, T = return period in years.

3.1.2 Gamma Distribution

A mathematical model to provide a reasonably good approximation of rainfall distribution is the incomplete Gamma function. This method not only provides a consistent basis for smoothing the curves but it also provides a means of investigating the space and time changes in rainfall probability analytically. The Gamma distribution is a positively skewed distribution which is applicable to climatological variables which have a physical lower bound of zero but no non-statistical upper bound such as one encounters with precipitation data.

Incomplete gamma function : The integral

$$\Gamma(\alpha) = \int_0^\infty x^{\alpha-1}\, e^{-x}\, dx \qquad (3.7)$$

converges if $\alpha > 0$, and is called the gamma function of α.

The gamma function is highly skewed and exists only in the positive region of the variable. The probability density function of this distribution is defined by

$$F(x) = \frac{\quad}{\beta^{\alpha}\,\Gamma\alpha}\, x^{\alpha-1}\, e^{-x/\beta} \qquad (3.8)$$

with $0 \leqslant x \leqslant \infty$ and $F(X)=0$ for $x < 0$. The shape parameter >0 and the scale parameter is $\beta > 0$. Since gamma function has two parameters it is difficult to integrate it. Simpson method may be used to estimate the distribution function.

3.1.2.1 Properties of two-parameter gamma function

The mode is $m = \beta^{\alpha}(\alpha - 1)$ for $\alpha \geq 1$. The expected value and the variance is

$$Ex = \mu = \alpha\beta \tag{3.9}$$

$$\text{var } x = \alpha\beta^2 \tag{3.10}$$

while the skewness co-efficient $Y_1 = 2/\sqrt{\beta}$ and the kurtosis $Y_2 = 3 + 6/\alpha$ are independent of β. Fig. 13 gives three curves of Eq. 3.8 for $\alpha = 2$ and $\beta = 0.5, 1.0$ and 2.0.

3.1.2.2 Estimation of parameter of gamma distribution

The parameter and are estimated from the sample data. For a highly skewed distribution, a maximum likelihood estimation is recommended. For two-parameter gamma distribution, $\mu = \alpha$, so that $\beta = \sigma^2/\mu$ and $\alpha = \mu^2/\sigma^2$. This may be satisfactory if the skewness co-efficient $Y_1 = 2/\sqrt{\alpha}$ is small or α is relatively large.

3.2 Testing of goodness of fit data to probability distribution

Because hydrologic information is primarily derived from sample data many practical hypothesis about the population of hydrologic random variables must be postulated and tested. Available techniques in mathematical statistics for testing various types of hypothesis are relevant to hydrology.

Two ways of judging whether or not a particular distribution adequately describe a set of observations requires a visual judgement of goodness of fit. One method is to compare the observed relative frequency with the theoretical relative frequency curve. The second method is to plot the data on appropriate probability paper and judge as to whether or not the resulting plot is a straight line. More powerful tools in testing the goodness of fit are Chi-square test and the Kolmogorov-Smirnov test. These two approaches require that the data are from a specified distribution. In this study the Chi-square test and the Kolmogorov-Smirnov test were adopted.

3.2.1 Chi-square Goodness of fit test

One of the most commonly used test for goodness of fit of empirical data to specified theoretical frequency distributions is the chi-square test. This test makes a comparison between the actual number of observations and the expected number of observations (expected according to the distribution under test) that fall in the class interval. The expected numbers are calculated by multiplying the expected relative frequency by the total number of observations. The test statistic is calculated from the relationship,

$$\chi^2 = \sum_{i=1}^{k} (O_i - E_i)/E_i \qquad (3.11)$$

where k is the number of class intervals, O is the observed and E is the expected (according to the distribution being tested) number of observations in the ith class interval. The distribution of is a Chi-square distribution with (k-p-1) degree of freedom, where p=number of parameters estimated from the data. The hypothesis that the data are from a specified distribution is rejected if

$$\chi_c^2 > \chi_{1-\alpha,\, k-p-1} \qquad (3.12)$$

A better way of conducting the chi-square goodness of fit test is to define the class intervals so that under the hypothesis being tested the expected number of observations in each class interval is the same. This means that the class intervals will be of unequal width and that the class interval widths will be a function of the distribution being tested.

3.2.2 Kolmogorov Smirnov Test of Goodness of fit

An alternative to the chi-square goodness of fit test is provided by the Kolmogorov Smirnov test. This test is conducted as follows :

i. Let $F(X)$ be the completely specified theoretical cumulative distribution function under the null hypothesis .

ii. Let $S_n(x)$ be the sample c.d.f. based on n observations . For any observed x, $S_n(x) = k/n$, where k= number of observations less than or equal to x.

iii. Determine the maximum deviation, D, defined by

$$D = \max \mid F(X) - S_n(x) \mid$$

iv. If, for the chosen significance level, the observed value of D is greater than or equal to the critical tabulated value (Table 5) of the Kolmogorov Smirnov statistic, the hypothesis is rejected. It is to be noted that for the Kolmogorov Smirnov test $F(x)$ is completely specified cumulative distribution. That is, no parameter for the distribution must be estimated from the observed data. It is found that when parameters must be estimated to specify $F(x)$, the Kolmogorov Smirnov test is conservative with respect to type I error. That is if the critical value is exceeded by the test statistic obtained from the observed value, the hypothesis is rejected with considerable confidence.

3.3 Determination of Probable Maximum Precipitation (PMP)

In 1951, Chow [6] expressed the general equation for a random hydrologic variable as

$$X = \bar{X}_N + K_M * S_N \qquad (3.13)$$

where X_T is the variate having a return period T in years, $\bar{X}$ and S_N are the mean and standard deviation respectively of the series of annual maximum. K_M is the frequency factor which depends on the type of distribution used and the return period.

Hershfield [12] used equation (3.13) in the form of

$$X_M = \bar{X}_N + K_M * S_N \qquad (3.14)$$

where X_M is the magnitude of PMP for a given station of a particular duration, $\bar{X}_N$ and S_N are the adjusted mean and standard deviation of the annual series respectively.

CHAPTER IV

DATA COLLECTION

4.1 Source of rainfall data

The rainfall records used in the study were collected from the Bangladesh Water Development Board. This organization measures daily rainfall by the standard 5 inch gauge having 1 foot rim height. The majority of the gauges operated by the BWDB are being operated since 1962, and in a number of cases rainfall data for some considerable period before 1962 are also available. This organization preserves the 24 hour amount in the form of data index card. For a particular water year annual rainfall data, number of rainy days in a year, monthly rainfall data, maximum depth-duration data etc. are available in the data card.

4.2 Study Region

Hydrologically Bangladesh is divided into four regions (BWDB,1982) (a) North-west, (b) North-east, (c) South-east, and (d) South-west. North-west region comprises of the districts (old) of Rangpur, Dinajpur, Rajshahi, Pabna and Bogra. This region is flaked by Brahmaputra on the east and Ganges on the south. Climatologically, the region falls under two distinct season viz. dry season from November to March and wet season from April to

October. Rainfall varies over the region from 53 inches in the west to 95 inches in the north-east. This rainfall is very unevenly distributed during the year. Over 80% of it occurs from June to October and the remaining 20% from November to May . June to October is known as the rainy season or monsoon. Slow storms of steady rainfall for several days is generally the pattern during this season, but sometimes localized high intensity rainfalls of short duration also occur. Sky remains cloudy for long periods and a high percentage of humidity persists.

4.3 Selection of Rainfall Stations

There are as many as 94 rainfall recording stations in the study region. The districtwise (old) number of rainfall stations are given below.

District(old)	No. of rainfall station
Rajshahi	26
Pabna	12
Bogra	12
Rangpur	21
Dinajpur	23

All the stations within the study area were identified and it was decided that more stations should be selected from higher rainfall difference areas. The other criteria being that the record for period 1962-85 should be complete or nearly so. With this point in mind the study region was divided into a number of grids and isohyetals were drawn on the map. More stations were selected from greater isohyet difference grids and vice versa. This exercise provided a network of 55 rainfall stations in the study region.

4.4 Data Collection

Out of 55 selected stations the data of 29 stations were collected from IBM System 34 database of the BARC computer centre. The BARC collected these data from BWDB. The required cumulative rainfalls were obtained by running appropriate programme in the IBM System 34 computer. These basic data were then transferred to BUET mainframe computer for further processing.

The data of other 23 stations were collected from BWDB data index cards. These data were entered and verified carefully and a databank was established to facilitate the use of collected data in various analysis. All the collected data were presented in Table 2.

An important aspect of the data processing was the checking of station location throughout the region , because this information is essential for the preparation of isohyetes of the analysed rainfall data.The corrected station locations was taken from Water balance studies report

(North-west data). In the report [2] the gauge location published in Hydrological yearbook (vol. 1, Raintall and Evaporation 1965/66) was checked against 1:50000 topographic survey map. The name and corrected latitudes and longitudes of the selected stations are given in Table I.

CHAPTER V

DATA ANALYSIS

5.1 General

To select a probability distribution in data analysis, it was decided that Gumbel and Gamma distributions, most commonly used in rainfll frequency analysis, would be applied to longterm records of annual rainfall extremes at selected rainfall stations over the north-western region of Bangladesh.

For each year of the record the anual maximum rainfall for 1 day and consecutive 2,3,5,7,10 and 15 day periods were extracted. Computer programmes were developed for data processing for both type of distributions. A listing of the programme is provided in Appendix C . Typical plotting of data in the two probability paper designed for the two distributions are shown in Fig. 16-22 and 23-29. The ordinate of the plotting represents the maximum rainfall and the abscissa represents the return period. The probability paper is so designed that the ordinate scale is linear and the abscissa scale is of double exponential type. Plotting position were determined by the formula

$$T = \frac{N + 1}{M} \qquad (5.1)$$

where M is the rank of the item of series.

The plotting positions and the parameters of the theoretical curve were calculated in the mainframe computer and these results were then transferred to TRSDOS system for plotting. Two plotter routines (developed in BASIC), one for Gumbel and the other for Gamma distribution were developed and are presented in Appendix C .

The goodness of fit were tested by Kolmogorov-Smirnov and Chi-square test.

5.2 Kolmogorov-Smirnov test

This test is usually performed for short samples (N < 30). Goodness of fit indices of the Gumbel and Gamma probability function were computed for 30 randomly selected stations. A computer programme based on FORTRAN was developed for this purpose. Table 8 and 9 shows the comparisons of differences between the critical and the computed Kolmogorov-Smirnov statistic. A comparative study reveals that Gumbel distribution is acceptable at 0.05% level of significance and is superior to Gamma distribution.

5.3 Chi square test

This test is usually performed for large samples (N > 30). In this test the equal probability class interval method was employed for 11 randomly selected stations of the region. Table 10 and 11 summarises the computed chi-square values. The tables show the number of successes and failures for each distribution, based on 0.05 significance level.

From the test results it can be seen that Gamma distribution has more successes than the Gumbel distribution. To choose one distribution as more reliable than the other, basing the judgements on the results obtained from Chi-square and Kolmogorov-Smirnov tests, presented in Tables 8,9 and 10,11 is difficult indeed. Though Chi-square test indicates that Gamma distribution is superior over Gumbel distribution, no definite conclusion can be drawn because of the small lengths of the samples for which chi-square test is not conclusive enough. Again Kolmogorov-Smirnov test indicated that Gumbel distribution is superior to Gamma distribution and is acceptable for the tested range of samples. Consequently Gumbel distribution is selected for further study in rainfall extreme value analysis.

5.4 Frequency Analysis.

From the test results it was decided that Gumbel distribution would be used for estimating rainfall extremes. Computer programmes were developed for estimating parameters of the prediction equation and maximum 1,2,3,5,7,10 and 15 consecutive day rainfall for return periods of 2,5,10,20,50 and 100 years for all the selected stations of the region. The results are presented in Table 13. A number of isohyetal maps were drawn using these results as shown in Fig. 30 to 36.

5.5 Generalized Depth-duration-frequency curves

For a generalized depth-duration-frequency curve for the whole north-west region, the results of the Gumbel fequency distribution were plotted in the logarithic paper. It was assumed that a relationship as suggested by Bernard [4] exist between the rainfall and duraion for a certain return period. Typical result of plotting for 20-year return period data was presented in the Fig. 37. Computer programmes (Appendix C) were developed to fit least square curves through the enveloping points. Correction factors for each station corresponding to each return period were determined to calculate the point rainfall value. The regional curves for different return periods are shown in Fig. 38. A nomograph representing these values has been developed and presented in Fig. 39. The design rainfall for the return periods can be calculated using this nomograph and the correction factor charts presented in Fig. 40 to 45.

Average ratios of 5-year ,10-year,20-year,50-year and 100-year maximum rainfall data of different duration to 2-year rainfall for each of the station was determined and the results are presented in Table 15. An emperical equation of 1,2,3,5,7,10 and 15 day rainfall for different return periods as a ratio of 1,2,3,5,7,10 and 15 day ,2 year value were then established by fitting the mean ratios as a function of return periods on logarithmic paper (Fig. 46) and is given by

$$\frac{P_T^{N\text{-}DAY}}{P_2^{N\text{-}DAY}} = 0.327 \ln T + 0.8019 \qquad (5.2)$$

where,

$P_T^{N\text{-}DAY}$ = maximum N-day rainfall value for T year return period.

$P_2^{N\text{-}DAY}$ = maximum N-day rainfall value for 2 year return period.

and N = 1,2,3,5,7,10 or 15

Same type of equations were also developed for the hydrological units set by the MPO. These are presented in Fig. 47 to 53.

5.6 PMP Analysis

The mean ($\bar{X}_N$) and standard deviation (S_N) of the rainfall sample for each of the station were computed by the conventional procedures [14] as given by

$$\bar{X}_N = \frac{\sum x}{N} \qquad (5.3)$$

$$S_N = \sqrt{\frac{\sum (x - \bar{X}_N)^2}{N}} \qquad (5.4)$$

The values of K_M were calculated by the equation

$$K_M = \frac{X_{MAX.} - \overline{X}_{N-1}}{S_{N-1}} \qquad (5.5)$$

where K_M is the frequency factor defined by Hershfield. The K_M values corresponding to each duration of each station were calculated and presented in Table 24. The distribution of K_M as shown in Table 25 gives the maximum value of K_M of different duration. These values, therefore, may be considered as the enveloping values of K_M. Thus the empirical equations for PMP values for the region under study may be written as :

(1-Day) $$X_M = \overline{X}_N + 6.49 * \overline{S}_N \qquad (5.6)$$

(2-Day) $$X_M = \overline{X}_N + 7.50 * \overline{S}_N \qquad (5.7)$$

(3-Day) $$X_M = \overline{X}_N + 7.86 * \overline{S}_N \qquad (5.8)$$

(5-Day) $$X_M = \overline{X}_N + 7.02 * \overline{S}_N \qquad (5.9)$$

(7-Day) $$X_M = \overline{X}_N + 7.32 * \overline{S}_N \qquad (5.10)$$

(10-Day) $$X_M = \overline{X}_N + 6.29 * \overline{S}_N \qquad (5.11)$$

(15-Day) $$X_M = \overline{X}_N + 6.70 * \overline{S}_N \qquad (5.12)$$

where,

X_M = probable maximum rainfall,

$\overline{X}_N$ = adjusted mean of the annual series and

$\overline{S}_N$ = adjusted standard deviation of the annual series.

On the basis of K_M and $\overline{X}_N$,enveloping curves were prepared for the seven durations as shown in the Fig. 63. Using the K_M values from Fig. 63 (corresponding to the mean annual maximum rainfall of the any duration), PMP values can be calculated using the equation as follows.

$$X_M = \overline{X}_N + K_M * \overline{S}_N \qquad (5.13)$$

Before calculating PMP values, all the $\overline{X}_N$ and $\overline{S}_N$ data are adjusted by the empirical adjustment factors given by Hershfield [12] but 1440 minute correction was not applied to the data. Fig. 12,13 and 14 show various diagrams for various adjustments.

In addition to the original tabulations from which series of annual maximums may be extracted to obtain the means and standard deviations, there are also generalized rainfall frequency studies (Gumbel distribution) from which these two statistics ($\overline{X}_N$ and $\overline{S}_N$) may be derived [14]. For this purpose the ratio of the mean to the 2-year return period (Gumbel distribution) values were calculated and the avarage was found to be 1.09. Fig. 62 shows a typical result of this analysis. This value may be used for estimating the PMP of a certain area (within the study region) for different duration as follows :

$$\overline{X}_N = X_2^{N\text{-}DAY} * 1.09 \tag{5.14}$$

where,

$\overline{X}_N$ = mean N-Day rainfall,

$X_2^{N\text{-}DAY}$ = N-Day rainfall having 2-year return period,

and N = 1,2,3,5,7,10 or 15

Next, the standard deviation S , may be obtained from the following equation,

$$S = \frac{X_{100}^{N\text{-}DAY} - \overline{X}_N}{3.5} \tag{5.15}$$

where,

$X_{100}^{N\text{-}DAY}$ = N-day rainfall having 100-year return period.

in which the divisor 3.5 is the number of standard deviation associated with the 100-year value when analysing a 50-year sample by Gumbel procedure. Values of divisor for various lengths of record are given in Table 26.

The PMP values of the seven duration can now be calculated using the Eq. 5.13 and the Fig. 43. For example, if the 5-day mean annual maximum rainfall is computed to be 8 inches from Eq. (5.14), Fig. 63 shows that 11.6 is the number of standard deviations. The sum of the mean plus 11.6 standard deviations provided the probable maximum rainfall estimate.

CHAPTER VI

DISCUSSIONS

6.1 Frequency Analysis

The investigation carried out in this study can be categorised under three headings : (a) determination of a suitable distribution for for the analysis of long duration extreme rainfall of Bangladesh. (b) generalization of the result obtained by the selected distrubution. (c) development of an empirical method to determine the long duration probable maximum rainfall (PMP).

During determination of a suitable distribution , two widely used distributions namely : Gamma and Gumbel were tested and it was found that Gumbel distribution is more suitable for application in long duration extreme rainfall analysis of Bangladesh. The analysis introduces a degree of smoothing to the relationships, but generally speaking, there were only a few anomalies. Most anomalies were concerned with the longer duration rainfalls. Another point worthy to note is that outliers at the extreme end of the fitted relationship become more common at the longer durations, particularly at 10 and 15 days. The result of the analysis e.g., the parameters of the prediction equation of the seven durations are presented in Table 12. A number of isohyetal maps were drawn and are presented in Fig. 30 to 36. These figures show the similar rainfall distribution pattern as that of the mean rainfall (Fig 3).

Fig. 39 shows the generalized depth-duration-frequency nomograph for the north-west region of Bangladesh. Extreme rainfall amount of any station can be calculated by using the nomograph and the correction factors listed in Table 14. This procedure was verified by developing computer programmes and the percentage of error was calculated. It was found that the percentage of error of about 90 percent results fall below 12%. Table 16 shows the calculated percentage of error of a few stations. The remaining 10 percent error varies from 13% to as high as 25%. For these results 99% confidence limit lines were drawn and the generalized points were plotted in the same graph. It was found that most of the generalized points fall within the 99% confidence limit line with a few exceptions. Fig. 54 to 61 show a few results of this analysis. As mentioned earlier these anomalies are concerned with the longer duration rainflls.

Fig. 46 shows the generalized depth-duration-frequency curve for the region under study. Generalised curve based on seven hydrological units (proposed by the MPO) were also developed and are presented in Figures 47 to 53. 1,2,3,5,7,10 and 15 day rainfall data having 2-year return period maybe converted to rainfall data having different return period e.g., 5,10,20,50 and 100 year by using these graphs and the 2 year isohyetal maps. Computer programs were developed for calculating the percentage of error. Identical results were obtained as that of the nomograph method as shown in Table 17. But the curves developed for hydrological units proposed by the MPO (Fig. 47 to 53) gave smaller error than the whole North-west regional curve (Fig. 46).

To study the three generalized methods comparative tables were prepared. Table 18 to 23 compares the predicted 2-year, 5-year, 10-year, 20-year, 50-year and 100-year extreme rainfalls of randomly selected stations calculated by the three generalized methods, namely, nomograph and correction factor, generalized curve of the north-west region of Bangladesh and the curves prepared on the basis of hydrological units proposed by MPO. From the tables it can be seen that the predicted values obtained from the three methods does not follow any general trend of variation. Values of Station No. 158 were grossly underestimated by the regional curve (Table 20). Also rainfall Station No. 203 was overestimated by the nomograph method (Table 20).

6.2 PMP Analysis

Examination of the values of K_M (Table 24) revealed that no systematic geographic pattern exists, suggesting that K_M occurs in a random fashion. As shown in the Fig. 63 , K_M values were then plotted against their corresponding means to investigate the possibility of this statistic varying with average rainfall magnitude. The figure shows that an upper envelope of the statistic, K_M, has a tendency to decrease with increasing rainfall magnitude. Hershfield [14] also found the same tendency when analysing short duration rainfall data of south-western United States. Enveloping K_M as function of mean serves a transposition purpose. For all station having the same mean, it is assumed that they have the same value of K_M. This assumption does not imply that the standard deviations are also equal.

The four enveloping 24-hour K_M value curves namely: (1) Hershfield's world envelping curve, (2) Curve based on the North Indian data, (3) Curve based on the northeastern data of Bangladesh and (4) Curve based of the north-western data of Bangladesh, are presented in Fig. 7. This figure shows that the curve obtained for the north-western region of Bangladesh is almost parallel to that obtained from the North Indian data and north-eastern data of Bangladesh. The distribution of K_M as shown in Table 25 gives the highest value of K_M of different duration. These values, therefore, may be considered as the enveloping value of K_M. The empirical equations for estimating the probable maximum rainfall (PMP) values for the region were presented in Eqs. 5.6 to 5.12.

The average of the ratio of mean annual maximum rainfall to 2-year return period rainfall was found to be

1.09. Hershfield [14] found that this ratio to be 1.06 for the United States. Therefore, the value 1.09 for Bangladesh appears to be quite reasonable.

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

7.1 Conclusions

The following conclusions can be drawn from the various analysis of long duration rainfall data performed in this study.

1. Gumbel distribution is relatively superior to Gamma distribution in the analysis of extreme value rainfall data.

2. For any location within the north-west region of Bangladesh, maximum rainfall depth for any given duration of 1,2,3,5,7,10 and 15 days and having 2,5,10,20,50 and 100 year return period can be calculated from the nomograph (Fig. 39) and the correction factor charts (Fig. 40 to 45).

3. The parameter of the prediction equation of individual rainfall stations as given in Table 12 can be used to compute the maximum rainfall depth of the seven durations and for any desired return period.

4. The rainfall data having 2-year return period as given in the isohyetal maps (Fig. 30 to 36) may be converted to rainfall data having different return period, e.g., 5,10,20,50 or 100 year etc. by using the curve (Fig. 46). For more accurate estimates the hydrological unit

curves set by the MPO (Fig. 47 to 53) may be used.

5. A quick estimate of PMP of different duration can be determined from the enveloping equations (Eq. 5.6 to 5.12).

6. Probable maximum rainfall of different duration can also be calculated by using the formulas (Eq. 5.13, 5.14 and 5.15) and the isohyetal maps having 2-year return period (Fig. 30 to 36).

7.2 Recommendations for further study

1. This study should be updated in future with increasing length of record which would allow a more reliable estimate of rainfall.

2. Similar analysis of rainfall data should be made for other hydrologic regions of Bangladesh, such as,

(i) North-east region;
(ii) South-east region and
(iii) South-west region.

3. Seasonal analysis of rainfall data of the region should be made to reveal the seasonal patterns of rainfall extremes.

4. The PMP analysis of rainfall should be carried out using whole Bangladesh data to check whether any systematic geographic pattern of K exists or not.

R E F E R E N C E S

1. Ackermann, W.C.,1964, Application of severe rainstorm data in engg. design, Bull. Am. Meteorological society. Vol. 45.

2. Bangladesh Water Development Board and UNDP, 1982. Water Balance Studies report, Final report volume I ; Surface Water part.

3. Bell, F,C., 1969 , Generalized Rainfall intensity-duration-frequency relationaships. Journal of Hydraulic Div. ASCE vol. 95. HY I.

4. Bernard, M.M., 1932, Formulas for rainfall Intensities of long durations,ASCE Transactions Paper 1801. vol 96. pp. 592-606.

5. Changrancy,T.G. and Hem Raj,1978, Appraisal of various methods used for Estimation of Design Storm in respect of Small catchments. Proc. of Sym. on Hydrology of rivers with small and medium catchment, vol. II. Pub. no. 130. Central Board of Irrigation and Power, New Delhi.

6. Chow, V.T., 1951, A general formula for hydrologic frequency analysis. Transections, American Geo-physical Union vol. 32.

7. Chow, V.T., 1945, Hand-book of Applied Hydrology. McGraw-Hill Book Company.

8. Dhar and Kamte, 1966, Indian Journal of Meteorology and Geophysics. vol. 17.

9. Hershfield, D.M., 1962, An Empirical Comparison of the Predictive value of Three Extreme value Procedures, Journal of Geophysical Research, vol. 67, No. 4.

10. Hershfield, D.M. and M.A. Kho4er,1960, An empirical appraisal of the Gumbel extreme-value procedure. Journal of Geophysical research Vol. 65.

11. Hershfield, D.M., 1961, Rainfall frequency atlas of the United States, Weather Bureau Technical paper no. 40.

12. Hershfield, D.M., 1961, Estimating the probable maximum precipitation. Journal of Hydraulics Division, Proceedings ASCE Vol. 87, no. 5.

13.Hershfield, D.M.,1962, Extreme raintall relationships. Journal Journal of the Hyd. Division. ASCE. Vol.88, no Hy6. Proc. paper 3319.

14.Hershfield, D.M., 1965, Method of estimating probable maximum rainfall, Journal of American Water Works Association, Vol. 57, no. 8.

15.Hounam,C.E.,Estimation of Extreme precipitation, Journal, I.E. Australia, vol. 32, No. 6,1960.

16.Huff. F.A. and Neill,J.C.,1959, Comparison of several methods for rainfall frequency analysis, Journal of Geophysical Research Vol. 64. no. 5.

17. International Bank for Reconstruction and Development, 1972, Bangladesh Land and Water Resources Sector Study, vol. VII, Technical Report No. 23.

18.Institute of Engineers, Australia (1977), Australian Rainfall and Runoff.

19.Khan, H.R.,1976, Determination of transplanted date and supplimentary Need for HYV Monsoon Rice Using Rainfall crop soil data, Bangladesh Journal of Water Resources Research Vol. 1. no. 1.

20.Matin,M.A.,"Analysis of Rainfall data for estimating the intensity-duration-frequency Relationships for the North-east region of Bangladesh", A M.Sc.Engg. thesis submitted to the department of Water Resources Engineering, BUET, Dhaka, June, 1984.

21.Manalo, E.B., 1976, Agro-climatic survey of Bangladesh, BRRI and IRRI.

22.Mcculoch, J.A.W., and Booth, M., (1970) : Estimation of Basin Precipitation by Regression Equation. Water Resources Research, vol. 6, No. 6.

23.Meyer, 1928, "Elements of Hydrology".

24.Morgan, A.E.,"Storm Rainfall of Eastern United States",Technical Report, Miami Conservancy Dist.

25.Narayan, V.V.D., Gupta, S.K. and Tiwari, A.K., Rainfall and Runoff analysis for rainwater management in Agriculture, Proceedings of the Symposium on Hydrology of Rivers with small and medium catchments, New Delhi.

26.Pharande, K.S.,& Dastane, N.G., 1964, Effective Rainfall, New Delhi Postgraduate School J.,Indian Agri. Res. Inst.

27.Raudkivi, A.J., 1979, Hydrology : An Advanced Introduction to Hydrological Processes and Modelling,Pergamon Press.

28.Rakhecha,P.R., Dhar, O.N. and Mandal, B.N., 1978, Proceedings of the Symposium on Hydrology of Rivers with small and medium catchments, New Delhi.

29. Rangarazan and Mazumder, 1966, Indian Journal of Meteriology and Geophysics Vol. 17.

30.U.S.Weather Bureau, Hydrological report no.33, 1956, Seasonal variation of the probable maximum precipitation. East of 105th Meridian for Areas 10 to 1000 sq. miles and durations of 6.12.24 and 48 hours.

31.U.S.Weather Bureau Tech. paper no. 38,1960. General estimates of probable maximum precipitation for U.S. West of 105th meridian for areas to 400 sq. miles and Durations to 24 hours.

32.Varshney, R.S., 1979, Engineering Hydrology, Roorkee Press, India.

33.World Meteorological Organization, 1965, "Guide to meteorological practices".

34.Wilson,W.T., 1963, Transactions ASCE, Discussion on paper no. 3431.

35.Yevjevich, V., 1972, Probability and Statistics in Hydrology. Water Resources Publication.

APPENDIX - A

Table 1 : Location of selected rainfall stations

Sl. No.	Station Name	BWDB No.	Location North deg.	North min.	East deg.	East min.
1.	Adamdighi	151	24	50.4	89	03.0
2.	Badarganj	153	25	42.0	89	02.0
3.	Badalgachi	152	24	57.8	88	54.0
4.	Baliadangi	155	26	5.2	88	27.1
5.	Bagdogra	154	25	55.4	88	51.8
6.	Bera	4	24	04.5	89	38.0
7.	Bhawaniganj	156	25	19.7	89	33.0
8.	Bhurungamari	159	26	10.9	89	41.5
9.	Bholahat	158	24	56.4	88	12.0
10.	Bhitargarh	157	26	25.8	88	37.0
11.	Birgonj	160	25	52.1	88	40.8
12.	Boda	161	26	11.5	88	34.7
13.	Chaugram	8	24	33.0	89	10.0
14.	Chilmari	163	25	32.3	89	42.6
15.	Chotodap	165	26	14.0	88	24.8
16.	Debiganj	166	26	7.0	88	46.0
17.	Dimla	167	26	8.0	88	55.2
18.	Dinajpur	168	25	38.5	88	39.8
19.	Hatibandha	174	26	07.4	89	08.7
20.	Joari	16	24	18.0	89	08.0
21.	Kaliganj	177	25	58.6	89	12.6
22.	Khansama	179	25	55.8	88	44.0
23.	Khetlal	181	25	02.2	89	07.5
24.	Kurigram	182	25	47.7	89	39.0
25.	Lalpur	184	24	00.0	88	57.5
26.	Lalmonirhat	183	25	54.4	89	20.2
27.	Mahipur	188	25	52.0	89	15.0
28.	Manda	185	24	47.5	88	42.3
29.	Mithapukur	186	25	35.2	89	15.9
30.	Mohadevpur	187	24	54.0	88	44.0
31.	Mohanpur	189	25	31.0	89	43.8
32.	Naogaon	191	24	48.0	88	56.0
33.	Natore	23	24	23.0	88	55.0
34.	Nawabganj	196	25	24.0	89	04.7
35.	Nithpur	194	25	01.7	88	27.0
36.	Nowkhila	24	24	37.0	89	48.3
37.	Panchbibi	198	25	11.5	89	02.3
38.	Pabna	25	24	00.0	89	15.6
39.	Panchagarh	197	26	19.0	88	34.0
40.	Patgram	200	26	21.0	89	02.0
41.	Parbatipur	199	25	40.3	88	54.0
42.	Phulbaria	201	25	30.0	89	00.3

Table 1 (contd.)

Sl. No.	Station Name	BWDB No.	Location North deg.	min.	East deg.	min.
43.	Pirganj	203	25	25.6	89	19.1
44.	Rangpur	206	25	44.2	89	15.8
45.	Ruhea	209	26	9.5	88	24.0
46.	Saidpur	210	25	46.4	88	54.8
47.	Setabganj	213	25	48.0	88	27.0
48.	Sherpur	33	24	41.2	89	23.0
49.	Sibganj	215	24	41.0	88	09.2
50.	Sujanagar	38	23	56.0	89	24.5
51.	Tanore	219	24	36.7	88	34.6
52.	Tentulia	220	26	28.9	88	20.4
53.	Thakurgaon	221	26	1.6	88	28.0
54.	Ulipur	222	25	38.9	89	36.7
55.	Ullapara	40	24	18.5	89	34.3

Table 2 : Annual Maximum Rainfall of Different Duration in mm.

Stn. No.	Year	Rainfall in mm. 1-day	2-day	3-day	5-day	7-day	10-day	15-day
165								
	62	152.4	192.3	216.1	298.7	329.4	403.8	459.7
	63	254.0	287.5	358.6	431.0	453.9	531.3	654.5
	64	152.4	152.4	196.8	304.7	378.3	468.4	614.4
	65	158.8	205.7	280.6	445.8	462.3	471.2	572.0
	66	162.6	213.4	274.4	325.2	374.7	438.3	581.6
	67	171.4	261.6	307.3	353.0	353.0	358.8	411.5
	68	174.0	330.2	466.1	500.9	550.0	711.2	744.8
	69	171.4	215.1	298.9	409.4	443.7	443.7	502.7
	70	109.2	169.0	190.6	243.9	255.3	329.0	381.1
	72	184.2	195.6	246.4	261.7	317.5	464.8	529.6
	73	104.1	119.4	149.8	151.1	204.5	274.3	412.7
	74	218.4	256.5	297.1	363.2	436.8	544.8	739.1
	75	205.7	259.0	309.8	458.5	539.7	629.9	708.3
	76	152.4	266.7	331.5	406.4	453.4	536.0	811.5
	77	216.0	343.0	447.1	523.3	528.4	532.2	542.3
	78	158.8	280.7	331.5	395.0	555.0	593.1	727.7
220								
	63	116.8	195.5	269.2	284.4	309.8	398.7	490.1
	64	186.7	208.3	288.3	378.5	435.0	574.9	834.1
	65	163.8	233.6	236.6	239.4	308.0	368.2	538.9
	66	167.6	231.1	285.0	384.0	391.6	414.5	531.3
	67	188.0	231.2	308.6	423.6	452.8	590.2	651.2
	68	317.5	408.9	553.9	558.2	589.2	590.5	789.6
	69	153.2	274.3	274.3	399.0	400.3	409.7	513.3
	70	182.9	232.4	250.7	394.2	501.1	592.3	738.8
	72	172.7	270.5	320.3	385.1	457.2	627.3	802.3
	73	243.8	281.9	339.1	390.6	475.0	533.1	848.3
	74	265.4	267.2	269.2	478.8	515.4	593.9	649.6
	75	179.3	232.7	315.3	388.2	420.3	610.9	716.6
	76	150.4	244.9	284.8	338.1	373.7	481.4	645.3
	77	288.8	297.4	359.2	475.4	488.9	528.2	657.6
	78	103.6	141.7	176.5	229.4	253.0	260.9	401.9
	79	219.7	274.3	452.1	453.4	509.8	528.8	813.1
	80	137.2	143.5	220.2	303.0	400.0	480.1	521.2
	81	221.5	275.3	343.9	459.2	641.6	784.6	798.6
	82	160.1	266.7	308.6	353.1	463.6	583.0	764.6
	83	194.3	197.3	294.6	381.0	514.3	577.0	701.8
	84	143.5	246.9	310.4	422.9	475.0	561.9	762.5
197								
	63	205.7	262.9	365.8	576.6	741.7	795.1	1023.7
	64	179.8	220.4	288.8	326.9	350.5	385.3	555.5
	65	190.5	279.4	398.8	515.6	627.4	759.5	970.5
	66	132.1	195.6	233.7	370.8	447.0	532.2	749.2
	67	137.1	187.9	218.4	307.3	383.5	459.7	518.5

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-day	2-day	3-day	5-day	7-day	10-day	15-day
197 (contd.)								
	68	162.6	254.0	342.9	395.7	471.9	601.4	672.6
	69	139.7	205.8	223.6	360.8	429.4	531.0	716.4
	70	88.9	139.7	186.7	278.1	344.2	356.9	379.8
	72	157.5	157.5	188.0	238.8	301.0	448.9	478.9
	73	228.6	246.4	246.4	266.7	287.0	292.2	370.8
	74	104.1	144.8	185.4	248.5	375.9	414.0	505.4
	75	94.0	127.0	154.9	248.9	271.8	292.1	434.4
	76	154.9	205.8	276.9	358.2	395.0	458.5	656.6
	77	143.5	212.1	243.6	372.4	374.9	473.2	572.3
	78	216.7	360.2	379.2	399.6	514.3	519.4	697.3
	79	190.5	251.5	280.7	435.1	482.6	527.3	611.6
	80	294.6	312.4	374.6	430.5	515.6	542.3	724.9
	81	185.4	259.1	283.2	358.9	449.1	624.3	626.9
	82	257.8	348.0	360.7	505.5	544.7	585.3	668.0
	83	133.4	227.5	313.6	392.3	471.1	610.9	727.8
	84	248.9	327.6	376.4	467.9	524.3	608.6	767.5
157								
	63	316.5	344.4	344.4	405.1	548.7	589.3	790.0
	64	149.9	194.3	229.5	357.8	368.0	437.9	539.5
	65	153.7	203.2	256.6	349.8	457.8	575.9	768.2
	66	166.4	205.2	274.3	347.0	449.9	471.8	641.2
	67	273.3	444.0	458.2	462.5	545.9	572.5	657.8
	68	150.1	269.2	347.4	420.1	510.2	633.4	842.9
	69	160.5	196.1	228.4	376.7	450.1	452.4	708.6
	70	165.4	211.1	244.1	413.1	417.9	451.5	790.1
	72	140.5	214.9	249.2	383.0	433.3	514.5	733.6
	73	163.8	183.6	237.6	354.2	378.6	512.0	647.3
	74	165.1	275.6	335.3	421.1	573.0	791.4	1154.6
	75	165.1	203.2	292.1	422.6	492.4	672.5	993.2
	76	157.5	247.9	308.3	391.4	565.3	691.7	891.6
	77	237.5	313.7	341.6	405.4	528.3	556.2	799.1
	78	136.4	240.5	319.7	481.4	614.8	614.8	806.3
	79	184.9	243.6	287.3	383.8	439.7	513.1	646.2
	80	154.2	181.4	256.3	346.7	510.8	560.6	649.0
	81	105.9	154.7	210.1	298.2	395.7	532.6	617.0
	83	173.5	313.2	356.4	433.9	497.9	611.4	788.0
161								
	63	211.1	217.5	230.7	394.5	447.8	470.7	602.1
	65	236.7	241.3	358.1	483.1	517.4	546.2	582.8
	66	196.9	228.2	335.4	414.6	452.7	490.3	629.7
	67	213.6	339.1	398.5	450.1	473.2	482.6	524.8
	68	195.3	256.5	353.8	379.8	416.0	552.4	286.7
	69	129.0	213.9	288.3	346.0	370.6	392.4	497.4
	70	150.1	188.7	190.2	270.0	289.3	343.4	442.7
	72	184.9	211.1	219.2	274.9	283.4	373.4	487.9
	73	169.7	224.3	298.6	327.0	415.4	538.1	684.4

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-day	2-day	3-day	5-day	7-day	10-day	15-day
161 (contd.)								
	74	190.5	267.7	282.4	355.1	403.4	446.0	589.8
	75	173.2	311.9	311.9	344.7	516.9	676.4	752.6
	76	133.4	199.9	225.1	243.4	369.4	440.2	518.7
	77	132.1	218.5	286.1	412.9	414.9	422.5	523.1
	78	181.6	260.3	314.1	395.2	449.0	457.4	559.2
	79	128.5	239.5	240.3	373.6	498.1	501.4	531.9
	80	157.0	210.1	288.5	325.6	386.1	492.3	605.3
	81	194.3	254.5	367.8	446.0	561.8	782.3	796.5
	83	166.1	169.1	204.2	255.0	318.9	385.9	508.9
200								
	63	133.1	210.6	237.8	301.8	360.5	367.6	524.5
	64	182.6	246.9	371.3	480.3	499.8	591.3	670.3
	65	158.9	201.2	256.6	288.1	299.9	456.0	580.7
	66	180.8	183.1	292.1	409.2	482.1	542.3	756.4
	67	183.9	245.9	312.7	348.8	448.7	497.5	683.5
	68	183.1	280.6	368.7	455.3	584.4	800.3	896.0
	69	161.8	224.0	261.9	353.6	416.6	567.9	733.0
	70	157.5	246.4	357.4	462.8	476.0	541.1	782.5
	73	100.3	142.2	180.0	225.9	299.4	500.4	683.5
	74	135.4	226.1	312.5	339.4	463.6	533.4	591.8
	75	135.1	214.9	228.1	296.5	339.1	521.0	646.5
	76	131.8	171.4	251.2	283.3	359.5	424.7	540.2
	77	129.5	152.4	171.5	303.5	326.4	351.8	391.1
	78	154.9	236.9	330.7	370.8	451.6	487.0	627.3
	79	141.0	175.3	222.2	271.8	362.2	502.9	650.5
	80	101.9	122.7	146.3	203.7	259.6	310.1	363.2
	81	90.2	101.3	124.5	147.3	224.3	251.2	252.0
	82	104.1	124.9	148.0	181.6	196.3	283.0	353.6
	83	248.9	273.1	407.7	425.5	548.7	569.0	675.7
182								
	61	99.1	170.2	178.6	227.2	240.2	269.7	377.9
	62	137.2	191.0	250.2	316.3	329.5	333.8	425.9
	64	127.2	184.1	241.3	289.0	380.4	423.6	439.5
	65	115.6	141.7	174.7	257.5	284.1	355.4	404.5
	66	152.9	200.1	279.9	314.4	363.2	459.4	554.4
	67	108.2	146.3	171.1	222.9	242.7	255.6	328.5
	68	147.3	203.2	219.2	311.2	353.6	475.8	509.4
	69	176.0	200.1	276.3	308.9	386.9	386.9	434.2
	70	157.5	183.9	233.2	305.1	371.9	490.0	496.8
	72	129.5	176.5	225.6	286.1	331.8	387.1	465.8
	73	235.0	381.0	458.5	584.4	693.1	710.9	962.5
	74	203.2	332.8	384.6	460.8	463.3	488.7	660.5
	75	88.9	149.9	208.1	217.0	217.0	222.1	312.3
	76	279.4	358.1	533.4	604.5	623.5	689.5	1050.1
	77	119.4	157.5	190.5	226.1	261.6	301.0	450.8
	78	115.6	153.7	153.7	248.9	259.1	311.1	345.5

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-day	2-day	3-day	5-day	7-day	10-day	15-day
182 (contd.)								
	79	284.5	374.7	374.7	411.5	495.3	558.8	630.0
	80	132.1	134.6	177.8	209.5	270.4	271.7	339.0
	81	134.6	162.6	195.6	246.4	246.4	254.0	313.7
	82	274.3	369.5	369.5	391.2	441.9	548.7	581.7
	83	215.9	241.3	312.6	312.6	334.2	457.4	580.5
	84	156.2	265.4	294.6	328.0	401.9	441.5	648.5
159								
	63	185.4	202.4	208.2	239.2	258.5	264.9	447.5
	65	129.0	214.1	281.4	335.3	451.4	459.3	504.8
	66	191.5	297.4	376.6	476.7	509.0	655.5	695.4
	67	205.7	234.2	304.8	403.8	499.8	565.9	743.3
	68	195.8	251.2	285.2	533.1	577.1	606.1	917.7
	69	184.2	217.7	302.7	374.7	506.6	646.3	880.0
	70	170.9	292.1	333.5	437.4	518.4	563.9	643.2
	73	179.1	283.2	333.5	454.9	455.7	501.7	741.6
	74	228.6	283.5	372.4	520.5	553.8	558.9	591.8
	76	152.4	274.3	360.7	416.5	568.9	741.6	853.4
	77	172.7	297.2	393.6	515.5	518.1	568.9	1000.7
	78	132.1	172.7	210.8	281.9	325.1	325.1	474.9
	79	132.1	208.3	208.3	264.2	403.9	407.7	537.2
	80	135.9	259.1	373.4	555.0	673.1	742.9	835.7
	81	109.2	169.4	182.1	279.4	306.6	377.2	420.4
	82	147.3	236.2	319.3	423.5	451.5	539.4	652.0
	83	183.0	342.2	405.7	475.0	514.6	583.6	623.2
	84	236.2	309.9	379.8	534.7	610.9	695.7	751.5
183								
	62	141.2	174.5	205.2	213.8	238.5	255.8	287.1
	63	161.5	187.9	206.2	257.5	283.2	283.2	493.0
	64	186.9	226.6	291.6	342.4	423.4	487.1	560.4
	65	142.7	242.0	298.6	345.1	362.8	397.6	528.4
	66	119.4	163.0	261.4	282.2	346.8	475.9	620.6
	68	211.8	258.0	307.3	432.8	443.4	550.0	703.1
	69	234.7	364.2	422.1	422.1	524.7	524.7	557.4
	70	136.1	166.8	217.1	294.3	331.1	366.7	485.6
	72	114.3	141.0	169.2	200.7	238.5	320.7	382.0
	73	238.8	431.8	472.4	520.7	571.5	571.5	765.8
	74	254.0	302.3	332.8	462.3	520.7	637.6	716.3
	75	137.2	162.6	219.8	219.8	270.6	359.5	463.6
	76	174.0	312.4	449.6	457.2	457.2	508.1	797.9
	77	196.6	259.3	274.0	416.6	432.6	460.8	563.0
	78	121.9	175.3	204.7	257.1	274.9	341.3	462.6
	79	150.6	262.4	262.4	323.3	383.8	454.7	612.6
	80	122.7	139.7	156.7	264.7	326.6	382.5	445.8
	81	154.2	229.6	302.5	398.3	421.4	421.4	466.1
	82	240.0	304.0	329.4	397.7	428.0	521.7	570.5
	83	139.7	157.5	206.0	226.3	235.4	302.3	311.6
	84	203.2	275.6	352.6	381.4	444.4	549.8	817.7

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-day	2-day	3-day	5-day	7-day	10-day	15-day
174								
	62	311.2	323.9	330.3	494.8	513.9	560.8	788.1
	63	200.2	310.1	392.7	470.1	520.9	614.9	921.7
	64	208.3	322.6	363.2	401.3	523.8	592.3	693.4
	65	158.8	195.4	221.7	366.5	423.7	522.5	562.6
	66	184.9	342.6	407.9	536.7	577.1	604.3	714.0
	67	275.1	275.1	275.1	275.1	292.7	374.0	492.9
	68	281.2	376.4	412.0	466.1	466.1	466.1	605.0
	69	146.8	183.6	223.0	325.5	387.2	460.6	616.4
	70	304.8	431.8	431.8	523.0	559.8	667.5	737.3
	72	184.2	285.8	315.0	351.6	360.8	400.4	692.3
	73	261.6	294.6	302.2	330.6	408.1	499.0	786.9
	74	182.9	246.4	380.3	575.9	794.6	941.2	1072.8
	76	188.0	280.7	288.4	364.6	412.8	551.3	673.2
	77	200.7	305.3	330.7	351.0	394.2	403.6	689.9
	78	177.8	189.7	197.3	267.2	282.4	290.0	442.0
	79	162.8	236.5	257.3	337.8	392.4	429.0	551.9
	80	149.9	208.8	277.4	365.0	412.5	451.1	490.5
	81	109.2	147.3	227.3	274.3	301.0	230.2	417.3
	83	160.5	230.4	287.5	388.3	454.4	491.3	595.7
	84	181.6	295.7	336.5	410.2	522.5	747.3	841.4
177								
	61	132.1	177.6	193.9	203.8	219.5	229.6	335.8
	62	165.6	170.2	190.2	323.8	399.2	417.5	502.8
	64	189.5	294.1	353.5	406.9	496.8	531.6	566.6
	65	113.5	192.2	195.4	231.0	271.6	326.2	474.8
	66	101.6	156.2	209.5	293.3	320.0	361.8	442.7
	67	137.2	156.8	173.1	206.5	267.4	272.1	283.2
	68	166.1	246.3	289.5	420.3	433.3	510.5	625.3
	69	160.0	201.7	253.5	290.7	291.0	385.6	495.2
	70	188.0	339.1	339.3	377.8	453.3	480.3	637.3
	72	114.3	193.0	228.6	330.2	363.2	497.8	627.3
	73	271.8	279.4	312.7	422.5	458.1	559.0	742.4
	74	266.7	304.8	325.6	373.9	423.9	423.9	443.8
	75	79.2	135.1	173.2	197.3	219.9	221.4	248.3
	76	139.7	170.2	180.3	239.3	262.5	367.9	473.8
	77	216.0	251.6	330.3	349.8	350.3	368.0	535.2
	78	190.5	232.7	247.2	290.1	318.0	325.8	406.5
	79	218.4	227.3	265.4	351.0	399.3	431.8	550.9
	80	133.3	171.4	182.1	261.4	337.6	363.5	434.1
	81	139.7	153.9	168.1	235.5	283.2	373.1	455.7
	82	165.1	198.1	214.6	320.5	354.0	374.9	420.0
	83	368.6	490.2	664.0	794.3	923.3	954.8	1258.1
	84	129.5	210.8	259.6	312.3	408.8	431.7	468.3
188								
	63	149.9	223.6	254.3	297.2	306.1	324.1	380.7
	64	165.6	195.1	272.6	378.2	491.3	538.3	578.0

Table 2 (Contd.)

Stn. No.	Year	1-day	2-day	3-day	5-day	7-day	10-day	15-day
		Rainfall in mm.						
188 (contd.)								
	65	121.9	159.0	203.4	230.3	245.3	267.9	339.6
	66	159.8	177.6	203.3	250.5	302.4	397.5	419.1
	67	256.5	459.7	612.9	816.1	839.5	866.4	869.9
	68	155.7	182.4	245.4	326.7	359.8	437.5	550.3
	69	154.9	210.8	233.7	234.2	270.7	372.8	447.5
	70	165.6	207.5	258.8	293.6	311.4	432.8	586.7
	71	158.8	179.1	185.5	213.5	268.1	271.9	312.5
	72	127.0	137.4	169.2	193.8	221.7	298.7	361.5
	73	184.2	311.2	362.7	426.2	492.9	526.0	536.2
	74	254.0	355.6	363.2	437.4	438.7	490.2	554.2
	75	101.6	101.6	132.1	175.2	180.3	249.0	297.2
	76	203.2	281.9	383.5	414.0	483.9	537.2	825.5
	77	242.6	315.0	324.0	335.4	421.8	435.7	479.2
	78	229.9	271.8	288.3	303.5	384.6	494.0	612.1
	79	128.3	228.6	265.4	369.6	388.6	395.0	623.6
	80	203.2	266.7	304.8	383.5	396.2	665.5	774.7
	81	179.1	215.4	248.9	289.1	315.7	317.0	404.4
	82	150.4	184.9	215.4	289.8	328.9	382.0	435.3
	83	203.2	241.3	265.4	326.4	394.9	510.5	587.9
	84	177.8	281.9	323.8	461.0	524.6	703.7	802.8
154								
	62	182.4	248.9	273.3	282.2	287.5	316.6	463.4
	63	86.9	146.3	187.9	244.0	269.1	294.0	396.1
	64	121.9	187.4	211.0	295.0	339.4	361.4	411.7
	65	92.2	130.3	163.8	221.5	253.3	332.0	360.3
	66	131.1	178.9	181.9	219.3	259.9	275.1	415.2
	67	74.2	116.4	131.6	131.6	155.0	230.6	284.9
	68	170.7	174.7	220.4	311.3	332.1	416.9	575.3
	69	144.3	204.8	283.5	307.4	330.3	375.5	421.9
	70	104.6	145.2	174.7	193.0	217.9	279.3	406.3
	73	75.7	119.4	159.0	198.8	212.6	255.4	422.9
	75	69.6	83.6	113.8	157.0	161.5	234.9	313.6
	76	97.0	188.7	264.6	365.4	404.8	462.7	686.6
	77	71.1	119.4	175.3	241.4	289.7	349.4	428.3
	78	62.7	91.5	129.6	182.9	246.4	292.7	355.6
	79	99.1	114.3	149.9	247.6	306.1	430.6	514.4
	80	119.9	177.5	210.5	265.6	333.0	423.9	434.8
	81	79.2	110.2	163.4	224.3	285.3	327.8	384.1
	82	75.7	121.8	158.6	213.9	236.7	284.4	347.8
	84	214.9	216.9	218.4	287.7	371.6	451.6	548.9
160								
	62	88.9	127.0	181.4	243.6	256.0	261.6	354.7
	63	116.8	151.6	173.2	233.4	277.6	343.6	413.7
	64	131.6	202.7	215.4	234.5	297.0	388.2	482.5
	65	167.6	233.6	284.4	333.7	333.7	405.1	495.2
	66	177.8	201.9	209.8	277.1	308.5	396.5	504.4

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-day	2-day	3-day	5-day	7-day	10-day	15-day
160 (contd.)								
	67	122.4	176.0	231.9	305.0	334.2	343.1	389.3
	68	197.1	276.6	336.5	376.4	404.3	499.9	544.8
	69	207.0	361.9	382.7	478.7	531.2	603.1	609.2
	70	157.0	240.0	276.8	319.9	328.3	366.4	467.8
	71	172.7	320.0	422.9	462.2	481.3	481.3	510.6
	72	144.8	254.0	283.2	287.0	332.7	353.0	388.8
	73	142.2	215.9	254.0	287.0	303.5	321.3	430.5
	74	210.8	249.2	336.8	372.7	375.2	388.5	489.7
	75	128.3	128.3	171.5	200.2	243.4	290.4	406.6
	76	245.1	271.8	274.3	501.6	501.6	567.6	619.6
	78	165.1	174.0	202.0	226.1	254.8	287.0	416.5
	79	146.0	190.4	214.5	240.5	286.7	346.2	364.0
	80	152.4	273.0	304.8	438.6	530.6	551.1	612.3
	81	132.1	182.9	215.9	238.3	251.1	294.2	397.1
213								
	62	188.7	206.2	209.2	235.4	261.7	298.8	458.5
	63	174.8	224.8	232.1	251.2	281.0	343.9	480.5
	64	79.0	117.1	137.9	187.2	242.3	342.4	454.7
	65	163.8	193.0	228.8	308.6	316.0	341.9	408.2
	66	164.1	202.2	244.1	274.6	299.9	339.5	528.0
	67	155.7	186.2	242.8	335.6	404.2	419.9	427.0
	68	150.6	210.9	242.4	322.7	352.3	427.0	556.1
	69	198.9	332.0	408.2	528.0	575.3	636.3	739.4
	70	162.6	233.0	297.3	353.6	370.9	509.1	640.9
	71	181.6	216.7	240.1	275.9	381.8	444.0	573.8
	73	180.3	210.8	252.2	359.4	464.1	464.1	497.1
	74	209.5	232.4	240.0	245.8	265.4	305.0	383.2
	75	102.4	152.1	215.6	254.2	265.6	322.7	348.6
	76	215.9	276.9	276.9	338.9	461.6	499.7	544.3
	77	130.0	251.7	334.3	388.4	407.7	414.1	419.1
	78	144.8	159.8	183.2	203.3	211.4	281.0	406.0
	79	213.9	236.7	286.3	330.2	394.7	479.8	600.5
	80	131.3	212.6	251.7	292.3	366.0	406.4	514.1
	81	74.9	112.2	149.0	187.6	205.1	237.3	248.9
	83	207.3	272.1	293.7	348.5	354.8	397.6	525.3
	84	201.9	261.6	311.1	348.9	410.0	439.7	519.6
167								
	63	142.5	204.5	272.3	365.8	402.5	420.8	501.1
	64	212.8	338.9	366.6	462.9	543.7	586.6	636.9
	65	124.0	206.8	206.8	273.6	322.9	367.3	466.4
	66	159.5	195.1	256.3	342.6	350.2	352.1	540.4
	67	173.7	191.2	239.5	297.4	378.7	406.1	414.2
	68	185.4	306.9	357.2	465.9	466.9	533.7	662.7
	69	130.8	196.9	224.7	319.9	329.3	403.7	528.0
	70	149.9	254.0	323.8	398.2	438.8	585.0	681.7
	71	130.0	236.7	261.8	299.1	390.3	393.9	459.9

Table 2 (Contd.)

Stn. No.	Year	1-day	2-day	3-day	5-day	7-day	10-day	15-day
		Rainfall in mm.						
167 (contd.)								
	72	113.8	190.9	211.8	262.9	273.3	392.4	467.3
	73	317.5	324.9	330.0	439.2	494.6	540.6	745.0
	74	196.8	312.4	341.6	343.4	426.1	510.7	624.3
	75	146.0	250.6	253.1	273.4	273.4	273.4	291.1
	76	149.9	249.9	306.9	368.7	452.2	708.7	785.9
	77	203.4	263.4	344.7	372.9	382.0	393.2	556.0
	78	197.4	257.1	258.4	313.8	343.0	402.2	453.3
	79	165.6	227.8	243.1	257.8	299.7	397.8	520.2
	80	141.0	165.1	221.5	352.6	461.3	483.4	566.7
	81	171.4	206.2	285.2	338.3	406.4	539.2	588.3
	83	137.2	252.8	254.6	298.8	428.4	454.1	575.2
166								
	61	127.0	124.4	152.4	179.3	184.4	193.3	350.7
	62	205.7	205.7	252.7	334.0	427.5	497.9	541.8
	63	182.9	274.3	274.3	430.5	433.0	492.0	749.1
	64	207.0	341.6	447.0	543.0	602.4	602.4	652.1
	65	148.6	246.9	361.2	603.8	797.3	901.4	1153.6
	66	205.7	231.1	259.5	299.7	343.3	430.7	518.3
	67	99.1	151.2	183.0	220.6	258.7	341.7	430.7
	68	199.4	279.4	364.5	401.8	452.1	554.2	582.9
	69	161.8	182.1	245.1	301.0	377.2	450.8	552.4
	70	157.5	198.2	198.2	234.7	317.5	475.0	510.7
	71	129.5	185.9	275.3	289.3	375.6	402.8	509.5
	72	115.6	210.9	238.8	311.2	316.3	343.0	437.0
	73	181.6	260.3	336.5	358.1	417.4	472.0	645.3
	74	162.6	247.7	262.9	303.5	364.5	409.8	524.6
	75	119.4	182.9	229.9	284.4	293.5	293.5	317.9
	76	208.3	261.6	322.6	450.2	542.9	542.9	579.7
	77	114.3	165.2	216.3	249.6	280.9	307.7	401.1
	78	139.7	253.5	339.9	339.9	403.1	403.1	573.2
	79	132.3	205.2	222.5	287.0	350.5	462.3	599.7
	80	134.1	186.7	240.3	315.5	385.1	460.8	533.4
	81	152.4	185.2	232.7	252.5	303.8	420.4	495.6
	82	139.9	202.9	213.8	387.0	397.9	436.8	470.8
	83	115.6	210.8	303.5	341.4	384.0	515.1	701.0
179								
	63	203.2	212.6	215.9	328.7	336.6	345.2	461.5
	64	133.1	155.0	173.5	229.4	247.9	273.6	356.2
	65	118.9	160.1	189.0	286.9	327.8	380.4	429.4
	66	167.6	223.0	252.9	322.5	329.6	347.0	540.8
	67	218.9	249.1	254.7	278.7	316.8	410.3	426.1
	68	170.9	250.1	311.6	386.0	392.9	455.9	489.4
	69	277.4	357.4	368.1	368.1	368.1	375.2	376.7
	70	178.3	196.1	203.0	290.0	353.5	442.3	607.0
	71	154.7	201.7	239.8	278.4	343.2	388.4	409.7
	73	315.5	371.6	383.5	390.4	390.4	409.7	535.2

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-day	2-day	3-day	5-day	7-day	10-day	15-day
179 (contd.)								
	74	249.4	249.4	253.0	280.9	280.9	354.1	354.1
	75	113.8	153.4	191.0	277.6	277.6	307.6	382.8
	76	234.4	283.2	315.2	507.7	522.7	564.0	725.0
	77	144.5	241.2	323.8	336.0	344.4	344.4	441.0
	78	209.8	233.9	233.9	319.0	341.3	362.4	416.0
	79	152.4	177.8	185.4	210.8	266.7	350.5	462.8
	80	119.4	152.4	233.7	315.0	342.9	434.3	487.7
	81	114.3	221.0	279.4	348.0	378.5	406.4	500.4
	83	127.0	139.7	165.1	198.1	259.1	348.0	422.3
	84	215.9	228.6	238.8	256.5	355.6	462.3	591.8
209								
	62	167.6	204.4	268.7	326.9	436.0	553.3	665.3
	63	205.7	266.7	326.4	355.6	420.4	552.4	618.3
	64	189.2	270.5	321.3	349.2	367.0	426.7	513.3
	65	205.0	228.4	257.6	364.0	377.2	425.5	469.0
	66	173.0	228.1	267.5	380.7	495.0	516.8	707.7
	67	281.4	450.3	543.3	580.1	580.1	763.1	863.0
	68	201.9	290.5	384.2	443.5	512.1	585.2	631.9
	69	160.5	271.5	289.0	309.8	362.0	459.3	621.4
	70	173.5	233.2	250.0	296.2	315.5	410.7	584.6
	72	149.6	229.1	232.4	235.9	253.2	317.2	375.8
	73	304.8	491.0	677.2	712.5	716.1	716.1	1012.0
	74	310.6	412.2	455.4	604.5	785.8	882.3	1116.0
	75	186.2	351.3	451.1	548.3	769.8	908.2	1143.6
	76	253.5	296.7	365.8	383.6	416.1	453.7	619.9
	77	184.1	267.9	322.8	366.2	366.2	449.7	508.0
	78	195.6	248.9	307.3	336.0	341.1	390.2	536.1
	79	170.2	207.5	323.1	390.4	448.0	550.4	633.6
	80	140.2	187.9	308.3	440.4	512.0	669.5	766.8
	81	364.5	371.6	483.4	484.2	603.1	610.7	642.0
	83	187.8	273.0	282.4	384.4	423.7	503.5	563.9
	84	204.2	211.8	300.5	391.4	419.3	515.9	731.6
155								
	63	241.3	282.0	294.2	337.4	356.2	407.0	443.8
	64	99.1	148.6	162.3	236.8	291.7	387.1	523.5
	65	96.5	113.3	137.7	215.8	234.7	253.6	325.3
	66	211.3	267.4	274.6	367.7	419.5	482.7	505.6
	67	175.5	298.7	397.5	472.2	483.4	485.9	523.7
	68	259.1	506.0	535.7	613.5	870.3	919.3	950.5
	69	253.5	262.4	270.2	379.7	491.9	676.3	906.7
	70	180.3	335.0	368.0	446.7	535.1	632.9	762.1
	72	55.6	80.2	95.9	132.7	136.5	176.6	189.1
	73	127.5	186.2	222.5	349.5	452.4	453.2	577.4
	74	113.0	178.8	244.3	300.4	338.8	382.2	529.6
	75	88.6	97.0	116.6	134.9	165.1	202.2	239.2
	76	165.9	233.4	257.5	322.3	349.7	376.4	548.0
	77	124.2	142.7	171.7	227.3	269.4	336.7	405.2
	78	123.2	190.5	250.7	411.2	460.5	525.2	548.3

Table 2(Contd.)

Stn. No.	Year	Rainfall in mm. 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
221								
	61	79.5	119.1	159.2	191.2	234.8	251.5	282.9
	62	145.0	207.5	289.5	468.6	503.4	537.2	598.9
	63	138.4	170.2	230.1	258.0	316.8	394.8	522.4
	64	226.6	257.3	300.4	485.1	578.0	661.6	839.8
	65	165.4	238.0	298.5	314.2	421.6	500.9	672.0
	66	159.0	227.6	296.7	418.6	533.4	653.0	858.7
	67	235.0	332.8	371.7	396.8	441.3	643.0	710.1
	68	209.6	285.3	312.2	379.5	422.9	463.6	600.3
	69	113.0	203.4	232.4	294.3	375.2	466.1	597.9
	70	245.1	303.0	429.2	525.7	561.5	616.6	806.8
	71	204.7	292.1	360.2	513.1	542.3	631.2	740.1
	72	277.4	329.5	345.0	388.5	545.8	639.6	669.6
	73	114.6	157.5	225.3	280.2	378.2	521.4	681.2
	74	91.7	112.8	165.6	248.0	321.9	427.3	552.2
	75	57.7	102.4	122.2	193.2	244.0	314.3	439.8
	76	164.8	285.7	346.9	420.0	477.8	633.9	838.4
	77	120.7	178.1	225.0	272.8	361.5	392.0	481.7
	78	195.8	308.6	469.1	485.9	532.4	589.8	727.6
	79	206.2	344.7	386.6	439.4	476.0	618.0	918.0
	80	147.3	178.6	234.2	260.6	395.0	447.5	554.5
	81	209.0	210.3	279.1	364.5	392.2	420.6	551.4
	82	181.1	291.3	311.1	335.0	335.1	384.8	401.4
	83	170.9	253.9	324.5	447.2	534.8	652.6	819.0
	84	148.3	184.1	225.5	253.0	294.9	366.2	439.6
199								
	62	89.2	104.7	111.8	139.2	147.1	173.3	218.9
	63	105.7	194.6	206.0	283.0	361.4	414.9	472.0
	64	104.9	130.3	144.5	169.6	195.5	238.2	302.6
	65	101.6	135.1	168.6	221.4	247.6	349.4	388.3
	66	141.2	200.1	258.5	300.1	326.1	327.4	365.5
	67	81.3	114.3	177.8	215.9	257.8	297.7	366.2
	68	127.0	193.3	243.3	344.8	407.3	539.8	625.2
	69	215.9	292.1	337.8	344.4	347.7	358.9	485.9
	70	155.4	206.2	214.6	251.5	266.0	279.2	425.6
	71	58.7	96.8	119.6	145.0	145.0	201.3	221.8
	72	40.1	76.2	88.9	113.0	125.7	136.1	195.1
	73	156.0	203.2	259.3	305.5	319.3	403.0	488.6
	74	139.2	179.8	240.5	300.6	317.9	348.3	568.8
	75	130.3	142.5	152.9	158.0	181.4	262.2	279.7
	76	179.3	196.8	209.0	226.3	240.5	285.0	435.2
	77	146.3	252.2	307.3	440.6	449.0	484.0	681.4
	78	180.8	180.8	197.1	329.2	351.1	361.0	539.0
210								
	62	101.6	122.4	139.0	203.0	203.0	230.7	280.7
	63	99.6	152.4	226.1	301.1	350.8	354.1	438.4

Table 2(Contd.)

Stn. No.	Year	Rainfall in mm. 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
210 (contd.)								
	64	119.4	195.6	212.1	227.4	250.8	274.2	340.1
	65	127.0	158.8	197.9	247.2	327.4	355.4	488.8
	66	147.3	205.7	295.9	349.2	349.2	373.3	390.3
	67	190.5	222.3	222.3	283.2	317.5	317.5	398.8
	68	196.8	268.4	420.8	461.4	527.4	542.7	643.1
	69	254.0	303.5	311.1	334.0	376.3	451.5	616.6
	70	179.8	260.9	288.1	314.5	337.3	439.2	581.7
	72	77.5	139.7	165.1	165.1	165.1	180.3	297.3
	73	134.6	190.5	259.1	421.7	447.1	472.5	548.8
	74	227.3	252.7	279.7	331.7	376.2	414.8	534.5
	75	130.6	190.5	195.8	207.0	215.4	240.9	289.1
	76	236.2	313.2	380.0	421.9	430.8	452.1	638.0
	77	111.8	200.2	228.1	259.9	284.0	315.6	479.4
	78	215.9	222.3	235.0	243.9	294.6	335.3	518.0
	79	148.6	178.3	195.8	281.3	335.1	408.2	561.8
	80	127.0	180.3	205.7	259.9	303.9	365.1	460.8
	81	95.2	126.4	177.2	202.1	244.5	266.6	313.8
	83	155.4	180.4	231.2	313.3	377.6	430.0	589.0
	84	162.6	241.3	287.6	303.3	325.4	395.8	534.0
168								
	61	88.9	101.1	101.1	177.3	181.9	181.9	310.2
	62	120.1	208.2	228.0	267.6	273.2	280.5	426.7
	63	102.4	127.8	140.7	175.3	189.8	228.6	288.8
	64	102.9	141.5	162.3	205.7	242.0	336.2	342.1
	65	187.5	192.6	192.6	223.1	260.3	311.2	367.1
	66	96.5	108.7	136.1	200.6	256.5	278.3	385.8
	67	113.0	149.8	178.8	289.3	301.0	322.6	329.2
	68	142.0	202.4	228.3	282.3	287.8	379.2	476.9
	69	256.0	313.2	341.1	358.4	402.6	545.6	603.5
	70	77.5	103.5	152.2	192.2	227.8	322.3	343.9
	72	86.4	91.9	104.6	141.5	156.2	199.4	224.8
	73	203.2	223.5	246.6	302.0	307.4	307.4	433.1
	74	215.9	264.2	335.3	348.0	356.9	478.8	708.9
	75	87.4	104.1	117.8	173.4	203.6	228.8	308.5
	76	142.2	185.9	206.5	277.5	353.0	408.9	555.7
	77	135.9	208.8	220.7	308.8	348.2	377.4	422.8
	78	176.5	177.5	199.9	239.3	252.0	253.5	400.6
	79	132.1	184.1	294.9	455.7	550.9	689.4	857.0
	80	139.7	190.5	249.2	263.4	306.6	414.0	476.2
	81	149.9	162.6	282.4	312.9	350.5	355.9	404.9
	82	114.3	158.7	166.8	180.0	182.5	235.3	309.3
	83	175.3	179.1	202.7	240.0	276.3	286.1	304.1
	84	100.3	171.9	217.6	219.6	259.5	282.6	410.1

Table 2(Contd.)

Stn. No.	Year	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
		Rainfall in mm.						
189								
	63	109.7	158.5	226.8	281.4	296.7	320.1	424.5
	64	170.2	172.7	195.6	299.8	329.0	386.9	457.3
	65	139.7	153.7	175.3	202.0	223.6	280.1	430.3
	66	118.1	169.9	191.2	228.8	254.7	274.7	378.5
	67	108.5	109.5	139.0	181.9	206.3	286.1	369.6
	68	119.6	172.4	197.6	288.7	366.7	512.7	603.9
	69	302.8	405.9	421.6	432.8	432.8	487.7	564.4
	70	121.9	187.2	205.7	258.5	263.3	284.1	463.1
	72	76.2	104.1	119.6	119.6	119.6	127.7	190.5
	73	118.6	167.6	233.6	269.4	277.3	336.5	403.7
	74	133.3	163.0	169.6	244.6	253.0	269.1	311.8
	75	132.6	134.6	134.6	151.9	165.1	240.5	246.1
	76	191.0	326.1	353.0	366.7	399.5	447.5	631.4
	77	130.0	225.0	249.9	355.5	414.2	431.5	466.8
	78	201.9	304.3	437.7	507.3	509.1	563.7	664.0
	79	88.1	152.1	224.5	330.2	382.0	485.1	657.4
	80	106.7	195.6	228.6	279.4	370.8	434.3	485.1
201								
	62	77.5	87.1	109.5	112.8	135.1	160.4	214.7
	63	94.0	129.6	152.5	173.8	191.6	262.5	320.6
	64	133.1	201.9	231.6	310.6	338.0	375.6	460.7
	65	176.5	212.1	230.4	277.1	297.4	357.4	407.9
	66	185.4	341.6	375.9	408.6	422.1	439.1	688.3
	67	168.9	209.5	262.9	426.8	466.7	504.9	592.6
	68	124.0	191.8	216.9	357.4	434.1	589.8	624.4
	69	274.6	446.0	480.3	515.1	537.9	592.4	706.2
	70	162.6	259.1	349.3	385.9	400.9	406.2	651.0
	72	134.6	215.9	229.9	239.1	243.7	263.7	365.4
	73	210.6	290.6	294.7	388.7	388.7	396.1	451.7
	74	158.7	208.3	251.4	265.4	296.1	351.8	586.8
	75	88.9	101.6	117.9	130.8	155.5	159.8	161.6
	76	130.8	157.0	158.3	159.1	207.5	253.2	257.5
	77	199.4	267.7	360.9	477.8	493.0	509.5	655.8
	78	135.9	165.9	249.7	277.7	347.5	347.5	532.4
	79	148.6	155.0	160.8	227.8	282.7	320.0	415.6
	80	190.5	217.2	226.1	269.2	305.1	345.7	409.2
	81	148.1	152.4	172.7	257.8	265.9	267.2	424.7
	82	118.1	200.4	234.7	283.2	283.2	345.4	442.0
	83	85.5	119.1	143.2	168.1	179.5	234.1	252.6
	84	190.5	201.9	218.4	218.4	231.9	274.3	328.9
196								
	62	152.4	304.8	304.8	306.3	306.3	323.6	349.8
	63	142.2	193.0	212.0	228.5	238.7	259.0	369.8
	64	127.0	158.2	203.2	256.6	335.0	395.9	416.2
	65	114.3	114.3	151.3	186.9	204.7	217.3	289.9
	66	109.2	134.6	167.6	210.8	210.8	246.3	342.8
	67	165.1	185.4	251.4	302.2	321.2	374.6	444.4

Table 2(Contd.)

Stn. No.	Year	Rainfall in mm.						
		1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
196 (contd.)								
	68	116.8	157.5	223.5	325.1	360.7	462.3	518.2
	69	279.4	368.3	383.5	408.9	436.9	492.8	508.0
	70	132.1	193.0	205.7	274.3	274.3	330.2	439.5
	71	88.9	156.2	201.9	241.2	265.3	375.1	471.1
	72	114.3	152.4	203.2	320.1	340.4	436.9	553.7
	73	304.8	381.0	569.0	650.3	670.6	726.5	746.8
	74	109.2	147.3	214.6	214.6	252.7	265.5	448.3
	75	129.5	134.6	160.0	172.7	193.1	257.1	285.0
	76	129.5	210.8	248.9	261.6	274.3	274.3	332.7
	77	111.8	152.4	172.8	221.0	261.6	302.7	357.8
	78	127.0	160.0	209.5	247.1	283.1	307.2	335.2
	79	126.2	155.7	182.4	285.2	328.4	390.6	442.3
	80	134.6	134.6	158.7	187.9	212.1	249.0	314.9
	81	170.2	218.5	251.5	322.6	342.9	342.9	370.9
	83	152.4	175.3	189.3	231.4	268.0	298.7	362.4
203								
	62	76.2	86.4	111.8	131.3	156.7	166.9	253.2
	63	129.4	189.1	214.5	236.6	251.9	269.6	403.2
	64	161.8	198.1	224.3	312.6	336.5	351.5	407.0
	65	116.3	116.3	128.3	163.6	179.8	234.7	242.3
	66	122.2	165.1	173.0	192.6	204.4	228.1	356.9
	67	111.0	122.7	173.5	236.7	269.2	282.7	375.4
	68	118.9	167.2	178.1	242.5	276.5	341.5	381.2
	69	132.6	243.3	323.6	338.4	338.4	352.1	414.1
	70	148.8	213.6	213.6	265.6	315.1	394.7	446.0
	72	89.7	114.0	141.6	150.0	160.9	169.3	217.0
	73	168.7	257.6	281.0	295.2	303.9	350.5	440.2
	74	88.9	145.6	154.2	252.9	269.6	299.8	393.0
	75	136.9	216.1	224.2	228.3	282.7	282.7	344.2
	76	148.6	295.7	347.3	354.4	354.4	371.1	475.0
	77	82.0	137.3	149.2	210.0	231.6	284.9	370.3
	78	121.4	134.6	218.9	226.5	252.9	270.2	358.3
	79	132.8	157.7	194.2	245.8	272.5	296.8	440.0
	80	142.7	145.5	147.0	209.2	221.2	269.4	325.0
	81	85.3	118.1	175.0	184.0	242.7	269.9	302.7
	82	107.9	149.8	153.3	160.0	173.2	200.9	276.4
	83	182.9	260.4	272.3	290.1	293.9	302.8	321.4
	84	153.7	251.5	283.3	330.0	340.2	346.5	587.1
206								
	61	181.9	227.1	261.4	299.0	301.8	314.0	406.5
	62	89.4	161.3	185.4	205.4	243.7	292.0	310.3
	64	123.2	150.4	207.6	286.9	371.3	403.8	420.3
	65	102.1	127.5	151.4	202.2	202.7	205.8	214.3
	66	86.4	131.3	164.6	212.4	215.6	306.2	369.5
	67	165.1	180.3	181.8	208.0	249.4	278.9	342.0

Table 2(Contd.)

Stn. No.	Year	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
		Rainfall in mm.						
206 (contd.)								
	68	206.0	276.6	329.9	423.3	462.9	544.5	633.4
	69	254.0	287.8	318.3	359.4	473.5	474.0	494.3
	70	128.0	136.1	166.6	205.4	206.2	267.3	399.6
	71	184.9	222.7	233.9	245.4	292.7	292.7	360.3
	72	147.3	162.5	162.5	170.1	184.6	224.0	224.0
	73	173.5	320.8	402.1	565.2	575.4	617.8	669.2
	74	188.0	246.4	285.8	327.5	362.3	362.9	504.4
	75	96.3	111.0	115.6	186.0	222.3	233.2	309.8
	76	237.5	359.4	444.5	460.5	481.8	557.3	873.5
	77	194.8	290.8	309.6	372.3	436.3	457.4	625.8
	78	162.6	210.9	252.3	312.3	312.3	312.3	440.6
	79	257.8	303.8	322.3	371.1	429.3	496.1	637.5
	80	210.8	212.6	212.6	278.1	300.7	447.5	542.8
	81	210.8	220.7	238.0	302.0	302.0	337.3	468.1
	82	192.3	237.0	287.3	309.4	332.2	359.1	444.9
	83	135.9	198.1	217.9	255.8	267.2	301.2	359.2
	84	219.2	334.8	361.2	368.8	404.9	440.0	790.8
153								
	62	186.7	188.7	190.0	218.3	255.9	263.0	263.0
	63	204.2	216.1	231.3	306.9	320.8	340.6	405.0
	65	121.9	198.1	213.8	233.1	253.9	301.9	367.2
	66	113.5	162.3	199.9	264.9	272.5	328.4	404.6
	67	205.7	218.9	226.5	241.4	269.7	355.8	487.0
	68	153.2	189.0	202.7	298.2	338.8	438.9	513.6
	69	338.3	377.7	414.5	417.0	417.0	462.0	488.1
	70	218.4	247.6	275.5	348.8	362.3	418.7	577.7
	72	101.6	191.8	191.8	196.1	198.1	208.7	313.2
	73	196.8	293.3	381.0	434.4	475.0	501.4	569.2
	74	177.8	209.6	227.3	293.6	296.1	311.4	479.9
	75	106.7	124.5	170.2	209.0	253.5	311.9	437.6
	76	188.0	294.7	330.3	332.8	437.0	452.7	683.4
	77	229.4	351.3	420.4	499.2	539.3	576.2	736.2
	78	180.3	200.6	213.3	231.1	231.1	248.9	366.1
	79	182.9	197.6	201.9	201.9	283.7	346.5	443.0
	80	120.6	134.6	143.8	198.9	259.8	305.1	385.1
	81	191.8	209.8	232.7	259.8	259.8	294.4	417.8
	83	102.9	138.4	160.1	260.4	264.2	289.1	438.9
	84	210.8	280.7	313.2	328.9	398.8	520.7	641.4
186								
	63	165.1	215.9	261.6	349.2	353.3	354.1	448.3
	64	181.4	329.5	370.1	373.7	377.5	377.5	392.3
	65	130.8	151.1	153.4	176.5	228.6	284.5	300.7
	66	146.1	222.3	266.7	374.2	386.0	494.0	621.0
	67	112.3	163.3	221.2	318.7	414.9	509.9	535.3
	68	228.6	306.3	350.7	477.7	560.3	690.5	762.4
	69	232.4	313.7	382.2	402.6	434.3	618.6	848.3
	70	287.0	306.6	335.0	425.5	496.5	572.5	736.3

Table 2(Contd.)

Stn. No.	Year	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
				Rainfall in mm.				
186 (contd.)								
	71	137.2	251.5	327.7	401.4	416.0	445.5	582.6
	72	203.5	221.3	249.2	267.0	279.7	279.7	300.7
	73	263.7	393.0	517.9	681.8	697.0	772.7	993.7
	74	191.8	233.6	263.1	444.0	530.1	629.5	805.2
	75	135.9	190.5	210.1	292.1	362.0	490.5	654.4
	76	180.3	326.4	436.4	438.9	438.9	438.9	718.1
	77	206.5	294.1	344.4	433.8	451.5	461.9	664.3
	78	177.8	193.3	223.5	321.6	332.3	350.5	457.8
	79	209.3	242.3	244.9	324.9	394.5	502.4	561.3
	80	121.9	121.9	161.3	191.0	236.7	287.5	353.8
	81	141.0	164.3	244.9	261.6	261.6	270.5	442.0
	82	147.3	203.2	225.0	228.8	250.4	281.8	370.3
	83	132.1	221.5	272.8	337.6	337.6	348.3	401.1
	84	190.5	259.3	312.6	349.2	368.8	405.8	583.7
222								
	62	209.6	220.0	263.7	275.9	339.7	386.9	387.4
	63	138.9	254.7	349.2	429.7	446.0	450.9	713.2
	64	127.0	203.2	273.1	350.6	527.3	639.3	689.7
	65	118.1	200.4	246.1	294.1	340.4	423.0	443.4
	66	168.9	248.9	302.2	340.3	418.5	554.9	591.5
	67	79.8	98.5	153.0	192.4	230.5	269.9	304.9
	68	218.9	296.6	331.1	401.2	449.0	575.3	623.6
	69	304.8	358.6	428.7	500.8	558.9	558.9	612.7
	70	175.3	215.9	287.1	300.1	427.8	488.8	503.3
	72	161.5	168.1	188.3	256.9	283.6	396.3	473.3
	73	292.1	393.7	520.7	698.5	711.2	711.2	756.7
	74	203.2	322.6	361.6	432.4	457.5	485.8	767.9
	75	117.3	199.1	199.1	266.2	266.2	266.2	309.3
	76	133.4	199.8	279.0	335.9	373.2	435.2	635.0
	77	83.8	125.7	163.8	220.5	277.4	369.4	527.3
	78	148.6	183.1	203.4	282.1	282.1	283.6	364.1
	79	177.8	266.7	355.6	381.5	439.6	480.5	580.9
	80	117.6	117.6	133.8	180.1	213.1	286.1	288.6
	81	159.5	193.5	217.4	249.8	281.1	291.1	432.5
	82	158.7	203.2	250.2	271.5	323.6	335.8	406.1
	83	114.3	172.7	177.8	252.2	252.2	282.6	347.4
	84	139.7	279.4	311.4	333.3	365.8	442.1	634.5
215								
	62	177.8	198.1	234.9	248.1	254.5	320.4	387.5
	63	86.4	114.8	123.7	123.7	142.1	171.1	241.1
	64	76.5	145.1	197.7	248.0	274.7	294.8	302.7
	65	179.3	260.6	277.1	361.1	429.2	481.4	597.0
	66	82.0	93.9	135.6	164.0	178.7	219.9	234.6
	67	90.7	126.3	156.8	194.9	215.2	225.4	238.1
	68	102.4	113.0	184.9	202.7	255.6	314.6	358.5
	69	82.6	138.5	177.9	236.3	270.6	329.0	349.3
	70	108.0	125.8	125.8	128.2	160.0	254.0	295.9

Table 2(Contd.)

Stn. No.	Year	Rainfall in mm. 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
215 (contd.)								
	72	129.5	215.9	229.1	250.0	255.6	306.4	369.9
	73	157.5	286.3	294.6	377.9	564.9	683.5	692.4
	74	134.1	134.1	134.1	162.5	239.5	263.6	325.0
	75	228.6	340.4	447.1	581.7	607.1	835.7	965.2
	76	118.9	215.4	238.3	251.5	266.7	288.5	319.0
	77	191.3	193.6	193.6	203.4	256.0	319.5	342.8
	78	181.9	181.9	181.9	202.0	202.0	209.6	272.9
	79	190.5	208.8	216.7	218.0	235.2	293.6	425.9
	80	179.1	195.1	195.1	195.1	262.1	262.1	274.0
	81	159.0	197.1	197.1	200.7	203.7	264.2	312.9
	82	83.8	101.6	113.0	113.0	115.6	222.2	224.8
	84	114.6	124.5	165.0	204.4	233.6	269.2	335.9
163								
	63	168.9	205.7	215.9	353.0	386.1	396.3	614.7
	65	139.7	200.7	266.7	297.7	311.1	415.2	425.4
	66	158.8	203.2	261.2	405.7	429.1	466.7	468.0
	67	91.2	131.1	145.0	198.8	255.9	255.9	255.9
	68	153.7	254.0	304.8	393.0	410.8	509.9	566.8
	69	222.2	378.9	425.9	457.1	500.3	502.3	513.8
	70	204.5	304.8	355.6	393.7	398.8	626.1	628.6
	72	181.6	236.2	290.6	326.7	346.3	449.0	624.3
	73	219.7	348.0	435.6	505.0	667.1	716.1	948.8
	74	168.9	309.1	418.6	582.4	672.0	725.0	814.2
	75	86.4	156.2	165.5	182.8	199.4	250.2	387.3
	76	88.9	152.4	190.5	243.9	317.6	326.5	449.6
	77	102.9	182.9	256.6	290.8	343.9	432.8	571.2
	78	99.1	174.7	215.3	266.0	277.9	327.6	364.4
	79	141.0	240.0	260.3	287.0	320.0	355.6	532.9
	80	88.9	106.7	157.5	213.5	232.4	307.8	326.9
	81	121.9	162.6	221.0	238.8	285.7	302.3	356.9
	83	116.3	201.9	201.9	271.5	329.2	329.2	349.5
	84	172.2	267.5	299.0	314.5	337.6	383.4	645.2
156								
	62	67.3	93.7	113.0	138.6	159.5	166.9	226.8
	63	102.9	168.9	177.8	210.6	219.2	243.6	403.6
	65	111.5	147.8	185.7	240.3	339.1	412.0	512.6
	66	101.8	157.5	187.6	251.5	277.2	353.4	457.8
	67	169.2	212.6	246.3	296.1	327.6	367.2	431.8
	68	100.6	176.0	183.4	238.7	304.1	355.1	421.0
	69	110.7	129.5	203.7	231.6	244.6	305.8	341.9
	70	145.0	198.3	228.8	239.0	275.1	397.0	430.0
	71	102.4	136.9	158.3	211.4	262.7	269.3	278.8
	72	135.9	247.7	253.3	253.3	368.4	477.9	504.6
	73	153.7	293.4	332.0	462.3	483.9	502.9	558.8
	74	158.8	187.0	275.6	343.4	355.6	369.3	614.1
	75	143.5	220.7	291.6	342.4	406.9	436.1	525.7

Table 2(Contd.)

Stn. No.	Year	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
		Rainfall in mm.						
156 (contd.)								
	76	184.7	307.4	352.9	358.0	358.8	380.6	469.8
	77	75.2	126.5	161.8	194.7	229.7	271.4	375.8
	78	73.4	95.0	118.4	165.5	176.2	204.5	337.3
	79	142.7	221.7	296.9	409.4	445.0	513.6	542.5
	80	152.4	160.3	164.4	203.4	270.5	329.5	446.4
	81	159.8	294.7	407.2	510.6	537.5	545.4	595.2
	82	104.1	153.6	156.9	187.9	208.7	241.2	245.0
	83	298.2	420.6	428.2	430.3	479.1	488.0	488.8
	84	247.7	281.0	328.8	372.0	372.0	387.0	614.1
181								
	62	68.6	70.1	94.8	129.3	165.9	169.7	216.2
	63	79.8	105.2	123.2	170.2	188.5	193.6	231.0
	64	106.2	177.8	204.0	225.6	225.6	242.1	314.3
	65	129.3	235.5	248.2	356.7	380.8	387.7	415.6
	66	64.5	102.9	111.8	187.0	195.9	195.9	220.3
	67	116.8	175.2	236.2	289.8	320.2	379.6	521.6
	68	148.8	275.3	287.2	383.6	518.9	669.0	744.5
	69	139.7	190.8	210.4	256.4	299.1	319.7	374.5
	70	88.9	147.3	162.5	211.3	236.7	366.7	417.4
	71	200.7	302.3	350.6	350.6	351.1	374.0	389.5
	72	77.0	106.6	129.5	176.5	182.6	220.9	297.8
	73	175.3	302.3	416.3	424.4	424.4	596.7	684.9
	74	154.2	160.6	165.4	209.1	214.2	280.2	356.1
	76	121.2	225.3	225.3	243.8	255.2	273.3	429.1
	77	133.4	133.4	148.6	174.9	198.0	242.6	333.5
	78	104.6	192.2	214.0	220.6	327.0	355.4	408.8
	79	102.9	126.9	126.9	161.3	216.1	240.2	379.9
	80	257.8	290.8	420.3	420.3	420.3	420.3	443.2
	81	177.8	209.5	240.0	290.6	290.6	319.8	344.1
	82	99.1	117.9	147.8	181.4	205.0	222.0	373.9
	83	292.1	482.6	501.6	511.8	572.8	572.8	582.9
	84	184.9	293.4	299.8	302.3	305.3	331.9	452.2
152								
	62	36.3	56.6	56.6	81.5	96.7	96.7	115.2
	63	105.4	121.4	126.5	134.1	172.2	213.5	238.4
	66	135.6	226.0	289.0	307.5	307.5	332.5	454.0
	67	62.0	102.3	151.1	156.2	165.6	251.0	270.8
	68	92.5	164.4	238.6	263.8	319.8	399.6	514.1
	69	132.6	205.3	254.0	339.1	411.3	470.7	543.6
	70	92.7	167.4	240.6	277.1	281.2	307.8	331.7
	73	196.8	350.0	407.2	503.7	509.0	621.8	770.6
	74	177.8	183.9	191.8	194.3	207.0	217.1	289.9
	75	143.0	199.1	212.3	249.9	268.2	274.8	304.5
	76	203.2	231.6	250.6	330.9	352.7	354.7	507.5
	77	203.2	252.5	286.0	302.3	307.4	415.8	476.8
	78	89.4	135.9	144.0	192.2	221.9	255.8	368.1

Table 2(Contd.)

Stn. No.	Year	Rainfall in mm. 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
152 (contd.)								
	79	123.7	166.1	173.5	195.8	288.7	326.0	432.1
	80	152.4	203.2	285.0	285.0	285.0	285.0	298.2
	81	95.2	114.3	120.7	194.3	222.2	224.5	274.3
	82	131.3	154.7	243.6	302.8	342.1	352.3	426.1
	83	121.9	174.0	197.1	211.6	259.3	273.8	321.3
	84	128.8	128.8	130.9	164.7	164.7	178.4	282.3
198								
	62	76.2	111.8	111.8	121.4	123.2	146.8	180.4
	63	101.6	130.3	177.8	196.8	286.9	291.0	360.4
	64	127.0	162.6	208.3	224.8	224.8	224.8	255.1
	65	121.9	221.0	232.4	315.0	329.4	340.8	359.3
	66	76.2	88.9	99.1	102.9	110.5	133.4	180.3
	67	157.5	172.7	223.5	252.7	271.7	366.9	467.2
	68	137.9	264.9	278.9	370.3	393.1	512.0	540.7
	69	208.3	242.6	264.2	312.4	359.4	418.6	483.9
	70	74.2	82.6	95.9	160.7	184.8	243.7	291.9
	72	87.6	103.6	119.4	209.0	209.5	243.9	373.4
	73	215.9	292.1	320.0	340.3	408.9	414.0	499.2
	74	237.5	247.9	258.1	279.7	297.5	330.9	460.4
	75	152.4	172.7	190.5	255.3	289.6	292.6	375.1
	76	203.2	243.8	254.0	276.8	281.9	304.8	507.7
	77	152.4	171.4	203.2	233.4	250.9	272.8	355.5
	78	121.9	196.9	219.7	309.9	426.8	528.4	673.1
187								
	62	83.3	83.3	119.2	133.3	145.7	167.4	179.7
	63	101.6	123.4	123.4	123.4	174.6	204.4	269.3
	64	73.7	108.0	149.9	164.1	164.1	187.0	259.8
	65	157.5	220.2	234.7	310.9	331.2	363.7	410.5
	66	99.1	131.6	136.7	164.9	181.6	215.9	261.3
	67	203.2	209.6	217.2	237.5	243.8	254.3	287.7
	68	92.2	133.9	181.9	225.6	288.6	392.0	486.1
	69	76.5	140.3	194.9	242.6	264.4	285.2	334.0
	70	120.6	168.6	180.0	180.0	181.5	202.7	256.8
	71	133.4	159.3	254.0	297.7	313.5	321.4	340.5
	72	190.5	282.4	350.2	361.4	377.9	460.5	506.5
	73	175.3	348.0	362.0	399.0	440.6	551.5	602.4
	74	193.0	195.8	218.2	219.5	231.4	293.7	373.8
	75	75.7	113.0	146.8	181.4	193.0	247.8	329.4
	76	188.0	225.8	267.7	293.8	315.6	325.1	410.2
	77	100.3	158.0	169.7	187.0	202.0	301.5	391.7
	78	149.9	175.5	182.4	271.8	283.7	301.5	326.1
	83	152.4	278.4	279.4	284.5	295.9	375.6	426.4
	84	100.8	177.0	223.2	288.0	328.1	364.9	438.3

Table 2(Contd.)

Stn. No.	Year	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
		Rainfall in mm.						
194								
	62	119.4	157.5	193.1	236.3	260.3	340.4	529.6
	63	123.2	144.8	162.6	168.9	226.1	226.1	260.4
	65	141.0	185.4	233.7	322.6	335.3	444.5	491.5
	66	87.6	119.4	143.5	166.4	171.5	243.8	326.5
	67	63.5	78.7	106.6	160.0	174.0	184.2	256.5
	68	61.5	116.9	132.1	163.7	187.9	302.1	344.0
	69	94.5	127.8	138.7	141.2	154.6	174.9	197.8
	70	112.3	178.3	203.7	236.2	267.7	273.0	337.8
	73	152.4	238.0	314.7	324.1	333.5	430.8	527.3
	74	92.2	101.6	113.0	179.4	236.5	271.8	387.8
	75	59.9	70.8	75.5	92.8	92.8	122.6	167.5
	76	159.5	176.0	182.9	194.8	261.3	316.9	345.3
	77	77.0	97.3	143.0	177.3	212.3	306.4	370.7
	78	142.7	164.6	170.6	185.1	238.4	259.2	371.8
	79	304.8	314.2	325.4	350.8	364.8	437.9	486.5
	80	79.5	111.2	130.1	168.5	189.8	215.4	308.7
	81	88.9	115.6	141.0	156.8	200.0	242.1	315.7
	82	76.2	132.1	147.8	147.8	166.4	228.3	285.7
	84	119.9	123.4	170.7	234.7	246.2	319.5	334.7

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
219								
	62	104.6	162.5	215.6	215.6	240.2	275.2	320.9
	63	64.0	75.4	119.9	143.3	143.3	154.7	237.7
	64	73.7	147.4	183.0	235.1	245.3	245.3	268.2
	65	279.4	337.8	419.1	477.5	508.2	552.7	577.1
	66	106.7	111.8	135.9	166.4	169.7	210.3	293.4
	67	112.5	154.4	172.7	231.1	248.8	325.5	385.0
	68	100.6	176.3	225.1	281.4	323.3	371.6	408.4
	69	173.2	187.7	205.8	221.5	246.4	282.2	303.8
	70	96.5	106.6	106.6	154.9	154.9	233.6	252.7
	71	147.3	228.6	279.4	284.0	347.8	375.7	445.2
	72	146.0	162.1	212.6	212.6	212.6	254.5	264.4
	73	142.7	153.7	193.0	250.1	275.7	383.5	406.3
	74	233.7	261.6	279.9	293.1	307.1	332.5	408.7
	75	73.7	133.4	151.2	179.6	223.6	252.0	385.4
	76	113.0	144.8	163.8	172.7	223.5	223.5	294.7
	77	130.8	161.8	195.5	253.2	295.1	399.8	433.6
	78	158.8	169.0	188.0	235.8	267.6	290.5	349.4
	79	118.1	171.9	184.8	201.1	215.3	224.2	328.0
	80	194.3	219.7	228.5	275.6	297.2	297.2	361.4
	81	152.4	190.5	254.0	368.3	414.0	414.0	467.4
	82	107.9	113.5	114.5	177.2	222.2	257.0	310.6
	83	99.6	140.5	151.9	190.5	190.5	202.8	258.3
	84	95.3	135.4	173.8	206.3	249.2	330.7	375.6
158								
	62	111.8	143.8	161.6	161.6	173.0	190.8	256.8
	63	63.0	121.9	128.3	144.5	190.2	207.2	220.9
	65	101.6	148.0	204.9	320.2	338.7	376.6	441.1
	66	215.9	217.2	217.2	226.1	269.2	301.0	350.5
	67	124.5	141.0	149.9	164.6	172.7	193.0	228.4
	68	106.7	149.4	197.7	252.3	309.4	337.3	461.8
	69	67.3	101.6	129.5	198.0	233.6	233.6	253.9
	70	114.3	185.4	196.8	198.9	214.4	277.6	383.5
	72	68.6	83.8	100.3	100.3	100.3	141.0	149.3
	73	157.5	230.4	267.2	324.6	324.6	324.6	481.9
	74	132.1	146.1	146.1	152.9	152.9	196.3	253.7
	75	52.8	72.6	120.4	120.4	130.0	130.3	167.9
	76	38.1	69.1	93.2	104.1	126.7	192.5	248.3
	77	200.0	253.3	273.6	285.8	292.9	424.2	512.3
	78	152.4	155.0	195.5	323.9	422.9	508.8	623.9
	79	224.8	246.4	267.2	274.6	292.4	308.9	463.5
	80	101.6	193.0	279.4	287.0	336.5	430.5	497.8
	81	212.1	308.6	364.2	420.9	447.5	551.7	729.7
	82	279.4	525.0	583.4	608.8	608.8	608.8	747.3
	83	146.1	158.7	158.7	165.1	224.8	224.8	301.0
	84	38.1	54.6	71.4	94.2	115.6	155.0	196.9

Table 2 (Contd.)

Stn. No.	Year	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
		Rainfall in mm.						
185								
	62	77.2	96.5	146.8	146.8	166.1	185.4	267.2
	63	110.5	133.6	133.6	175.8	226.6	268.8	332.4
	64	90.2	98.8	130.8	143.5	162.8	201.7	287.7
	65	190.8	258.6	342.9	441.4	453.5	481.0	507.2
	66	81.3	135.9	142.3	156.3	167.7	179.1	218.1
	67	90.2	106.5	137.0	190.0	206.5	238.3	295.5
	68	104.1	205.7	239.7	316.9	363.9	378.9	406.1
	69	118.6	182.6	234.7	252.4	275.3	313.7	372.1
	70	97.8	108.0	139.2	154.5	185.0	205.0	282.3
	71	125.2	209.3	261.4	399.6	538.0	546.9	568.2
	72	53.3	86.8	86.8	98.7	105.1	117.5	139.2
	73	69.8	95.2	113.0	153.4	189.0	198.9	227.4
	74	210.8	229.1	238.0	245.6	303.6	378.4	494.0
	75	101.6	115.6	137.2	191.3	226.8	269.5	344.7
	76	304.8	312.9	314.2	319.5	324.1	376.1	456.6
	77	117.9	144.6	174.1	225.3	317.0	349.0	544.1
	78	123.2	141.2	193.1	216.9	259.1	302.0	426.0
	80	241.3	266.2	288.8	288.8	288.8	288.8	288.8
	81	152.4	206.5	253.5	277.9	296.9	355.5	389.8
	82	82.5	96.5	123.6	146.4	205.3	217.9	276.8
	83	160.0	179.1	181.6	194.3	221.0	224.5	284.5
	84	146.1	160.1	179.2	282.6	315.7	374.1	400.8
191								
	61	101.6	124.4	193.0	248.9	279.4	298.4	306.0
	62	127.0	142.3	162.5	167.1	183.1	244.1	335.7
	63	81.3	96.5	102.9	110.5	148.6	188.0	229.9
	65	177.8	260.4	273.1	353.2	396.9	396.9	523.1
	66	61.2	92.0	92.0	130.3	138.7	162.8	229.6
	67	171.4	212.0	215.8	247.5	256.4	258.4	314.3
	68	110.5	144.8	204.5	277.6	357.4	380.7	440.9
	69	100.8	184.9	207.5	264.2	288.3	310.9	350.8
	70	124.5	160.1	179.9	179.9	191.6	202.8	256.2
	71	73.7	135.9	158.8	158.8	177.6	254.0	294.1
	72	104.1	122.8	148.2	148.2	184.3	204.1	277.3
	73	177.8	266.7	306.1	387.9	429.0	497.6	586.5
	74	177.8	193.0	201.1	217.4	217.4	231.5	316.5
	75	108.0	109.3	127.3	192.3	233.7	248.4	316.4
	76	145.1	149.7	170.7	199.7	205.2	247.9	379.9
	77	119.6	226.3	282.2	292.9	308.6	396.7	524.6
	78	251.5	259.1	259.1	263.2	263.2	284.7	429.0
	79	113.0	167.6	203.1	220.9	295.3	332.9	477.7
	80	194.3	248.7	363.5	364.5	364.5	364.5	391.1
	81	156.7	157.7	157.7	217.2	222.8	252.2	311.7
	82	109.2	128.0	130.0	135.1	142.5	212.3	233.9
	83	218.4	261.6	262.9	264.2	353.1	365.3	388.2
	84	110.7	168.7	175.3	219.5	301.8	318.3	378.5

Table 2 (Contd.)

Stn. No.	Year	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
		Rainfall in mm.						
156								
	62	77.5	87.2	120.7	120.7	162.6	172.3	238.4
	63	99.1	128.3	133.4	135.4	177.3	216.7	283.2
	65	139.7	260.4	278.2	376.0	412.3	412.3	442.8
	66	74.9	95.3	128.2	162.6	162.6	186.7	278.4
	67	101.6	152.4	165.1	190.5	190.5	284.5	297.2
	68	101.6	155.2	193.6	249.7	326.1	374.7	445.2
	69	104.1	147.3	187.9	224.0	240.0	255.7	315.2
	70	165.1	223.8	262.2	269.8	288.1	288.1	306.0
	71	112.8	196.6	212.0	283.1	340.2	340.2	430.3
	72	76.2	106.7	120.6	186.6	213.3	255.2	358.0
	73	90.2	147.4	195.1	257.8	297.4	370.9	392.0
	74	96.5	143.5	156.2	180.6	223.5	261.6	364.6
	75	119.4	182.9	182.9	203.2	304.8	317.0	374.4
	76	109.5	155.0	237.8	263.7	301.3	314.0	438.5
	77	118.1	227.3	295.9	335.8	356.9	433.9	543.4
	78	96.5	156.9	198.8	243.8	253.0	253.0	317.6
8								
	61	43.9	75.7	96.5	134.5	165.0	183.6	190.5
	62	144.8	144.8	165.1	165.1	206.3	226.6	243.7
	63	71.1	106.7	156.2	217.0	256.7	302.4	414.3
	64	109.2	182.6	230.4	230.4	256.8	261.9	288.3
	65	208.3	316.3	383.6	429.6	482.2	591.2	597.3
	66	70.1	111.2	169.6	181.5	196.0	208.7	305.7
	67	78.5	94.7	105.6	121.7	151.1	200.2	247.4
	68	153.7	203.7	226.1	298.5	331.0	339.9	389.3
	69	116.8	198.3	236.7	347.4	368.5	378.2	416.3
	70	154.4	168.4	256.0	308.8	329.9	329.9	385.8
	71	109.2	142.2	152.4	167.9	180.1	217.7	312.9
	72	85.1	85.1	107.9	110.4	119.3	182.8	236.1
	73	179.1	201.9	259.1	321.3	336.6	387.4	473.8
	74	152.4	182.9	200.7	209.5	311.2	390.0	524.6
	75	146.1	172.8	207.1	242.7	311.3	385.0	467.3
	76	139.7	162.6	227.3	251.4	265.6	310.6	371.4
	77	120.7	182.9	221.0	268.0	281.9	367.0	419.1
	78	146.0	171.4	176.5	195.6	204.5	204.5	312.5
24								
	61	129.8	168.4	168.4	245.4	249.7	271.1	339.5
	62	58.2	96.6	100.9	109.6	112.4	115.7	176.7
	63	138.9	152.9	225.8	239.8	244.8	357.7	406.7
	64	142.8	225.6	236.3	247.0	251.1	268.1	289.7
	65	139.9	164.5	185.9	236.6	272.3	327.7	365.8
	66	115.1	177.6	202.8	316.8	333.3	376.0	496.4
	67	110.5	156.2	166.6	175.7	184.8	322.8	341.0
	68	129.3	155.0	208.6	278.2	314.0	323.9	356.4
	69	160.0	248.4	307.8	394.6	429.4	453.8	476.2
	70	129.3	150.4	154.5	171.3	185.5	223.1	235.1
	71	108.0	172.8	173.6	175.4	177.7	200.0	277.7

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
24 (contd.)								
	72	189.2	218.0	220.3	254.0	255.0	320.6	320.6
	73	153.9	213.6	349.7	349.7	359.9	418.7	441.1
	74	107.7	208.0	243.3	285.2	310.9	359.4	527.6
	75	132.8	217.9	219.2	240.7	259.3	280.8	391.8
	76	152.4	215.9	247.1	310.6	377.9	377.9	507.4
	77	91.4	108.4	162.8	185.0	269.6	311.0	364.3
	78	57.2	85.1	91.2	143.0	178.6	181.1	251.0
	79	92.5	151.2	152.5	183.3	214.1	278.8	373.4
	80	92.7	118.6	135.9	157.0	186.1	243.5	267.2
	81	76.2	130.3	158.2	201.4	218.7	224.8	274.1
	82	83.8	103.4	121.1	204.9	207.4	260.8	278.6
	83	138.9	234.1	306.5	324.0	367.7	374.0	376.5
	84	152.4	221.0	252.8	306.2	343.0	343.0	423.0
33								
	62	365.3	447.1	447.1	483.4	502.2	536.9	904.6
	63	268.0	307.8	307.8	331.8	523.3	646.2	749.1
	64	230.4	345.0	352.1	352.1	352.1	355.7	418.4
	65	145.5	214.3	234.6	337.2	360.3	381.1	400.1
	66	120.7	142.8	166.7	204.8	240.6	258.4	410.1
	67	151.1	171.4	256.5	326.3	342.3	414.7	450.5
	68	151.1	207.0	243.1	325.7	361.5	374.2	407.2
	69	93.2	153.0	205.1	280.3	334.1	348.6	404.2
	70	207.0	237.5	281.7	328.9	373.3	394.2	476.3
	71	275.1	323.9	359.2	364.0	420.9	420.9	437.9
	72	129.5	146.0	152.4	168.9	198.6	243.8	328.9
	73	134.6	198.6	209.0	279.6	298.7	349.2	460.9
	74	80.0	134.6	171.2	200.7	250.3	341.2	474.9
	75	119.2	149.5	214.8	245.1	271.9	306.5	442.6
	76	138.4	209.5	231.3	248.0	262.0	286.1	419.7
	77	82.3	138.7	220.0	267.0	310.5	334.4	409.3
	78	127.0	169.2	230.8	269.2	280.6	294.8	418.5
	79	108.7	209.8	211.1	306.8	409.2	424.4	617.7
	80	114.3	128.8	173.2	184.9	219.1	297.6	320.2
	81	113.0	156.2	176.5	199.4	222.2	286.3	351.3
	82	76.2	129.5	141.0	143.5	190.5	199.9	274.1
	84	152.4	208.3	236.2	295.1	325.6	330.7	479.1
40								
	61	87.4	118.4	133.4	189.0	235.9	291.3	369.8
	62	161.3	198.4	206.3	223.5	223.5	234.1	277.8
	63	85.1	117.1	158.8	189.3	235.0	266.7	365.2
	64	158.8	294.6	348.0	358.2	378.0	381.0	381.0
	65	165.1	210.8	293.4	374.6	468.6	485.1	693.4
	66	88.9	143.3	187.7	211.9	243.1	252.1	335.8
	67	143.5	180.6	201.4	221.5	231.2	273.8	286.8
	68	104.4	140.7	140.7	157.2	219.9	284.7	332.7
	69	76.2	149.9	198.0	261.5	294.5	319.9	355.7

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
40 (contd.)								
	70	132.8	188.9	214.3	294.8	313.8	390.0	400.2
	71	195.6	226.1	289.6	304.0	308.5	321.5	451.9
	72	96.5	114.3	122.4	122.4	137.6	188.4	188.4
	73	146.0	224.1	228.1	269.0	305.1	368.8	484.4
	74	148.6	166.4	295.9	325.4	351.0	376.4	477.6
	75	113.0	208.5	282.2	322.9	353.3	362.7	555.2
	76	138.4	190.5	191.0	203.7	240.9	276.2	309.2
	77	127.0	188.0	240.1	317.3	335.6	363.0	413.8
	78	129.5	145.8	173.7	195.6	215.0	273.9	332.4
	79	231.1	362.2	397.8	456.4	460.8	515.6	546.4
	80	119.1	155.2	169.4	213.4	316.7	326.4	353.3
	81	108.2	141.2	155.2	167.6	194.8	226.6	276.4
	82	59.7	86.4	86.4	96.0	107.7	120.1	157.5
16								
	62	48.0	91.7	104.7	141.2	200.9	217.5	287.9
	63	74.4	106.7	109.7	124.4	163.0	227.3	241.3
	64	121.9	191.7	261.5	292.0	292.0	324.0	415.3
	65	222.2	304.7	339.0	362.4	368.0	409.4	432.2
	66	141.5	146.3	146.3	158.7	159.7	171.2	223.7
	67	148.6	167.6	191.7	201.9	250.7	273.8	345.0
	68	184.2	205.8	229.7	307.9	365.8	398.1	535.7
	69	129.5	188.4	239.2	313.9	346.4	366.7	431.5
	70	97.8	142.3	165.2	225.2	252.3	284.0	324.9
	71	108.7	130.8	151.2	212.5	232.3	269.1	312.2
	72	116.8	157.5	251.4	252.7	252.7	252.7	270.5
	73	190.5	190.5	251.5	321.8	328.2	501.7	547.4
	74	80.0	123.9	132.0	174.0	210.9	237.1	290.4
	75	186.7	246.4	300.0	359.7	361.2	406.9	607.0
	76	139.7	198.1	204.7	221.2	241.5	268.5	350.0
	77	176.5	224.8	232.7	358.4	454.2	515.9	650.3
	78	102.9	108.0	108.0	180.4	180.4	217.7	240.1
	79	234.9	285.7	285.7	301.0	326.4	326.4	366.8
	80	102.9	132.6	144.0	144.0	160.5	208.0	264.9
	81	138.4	199.6	246.6	264.2	273.8	289.1	415.3
	82	87.9	90.7	92.5	92.5	105.4	126.2	166.1
	83	95.3	118.9	158.0	188.0	221.8	278.7	317.2
	84	103.4	176.3	208.6	228.4	248.4	271.5	339.4
23								
	62	142.2	170.1	197.8	248.6	256.5	298.6	444.9
	63	91.7	142.0	171.2	240.6	240.6	240.6	301.2
	64	114.3	204.5	253.5	305.6	320.1	331.5	446.6
	65	354.3	430.5	542.3	592.6	597.7	638.6	697.6
	66	135.9	147.3	204.5	246.4	248.9	258.8	267.9
	67	74.2	99.8	116.6	133.1	136.1	197.3	250.6
	68	130.6	194.1	238.6	302.8	338.1	361.2	418.9
	69	127.0	205.0	243.1	273.7	300.9	317.9	345.0
	70	132.1	156.2	188.0	194.9	207.2	241.9	289.1

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
23 (contd.)								
	72	74.7	79.2	82.0	114.3	125.5	161.4	219.4
	73	124.5	140.7	177.5	257.6	296.9	328.4	354.3
	74	88.9	136.4	180.1	188.7	246.9	306.8	363.6
	75	63.5	124.5	142.3	199.5	210.9	234.6	361.4
	76	110.5	174.0	193.0	239.7	260.0	263.3	404.0
	77	152.4	190.0	220.7	276.3	323.3	359.6	468.6
	78	133.3	169.6	201.8	238.9	246.6	256.5	328.2
	79	221.7	291.5	291.5	291.5	348.9	354.5	428.1
	80	91.4	144.0	188.7	202.2	205.2	230.9	332.5
	81	82.5	150.3	169.3	220.1	239.8	314.7	335.5
	82	49.5	69.3	76.2	76.2	108.1	128.0	164.9
	83	165.1	224.5	227.8	238.0	238.0	296.2	309.4
	84	127.5	149.6	176.1	203.3	204.7	219.7	329.3
184								
	62	113.0	144.8	158.8	158.8	172.0	198.2	237.6
	63	80.0	97.5	121.4	129.8	160.8	198.1	268.2
	64	171.4	250.7	270.8	270.8	295.7	348.2	363.0
	65	223.3	334.3	355.4	364.0	417.4	485.7	488.0
	66	101.1	129.0	184.4	190.0	200.7	241.9	289.7
	67	124.4	147.8	160.5	194.8	203.2	295.1	310.6
	68	212.1	240.0	262.9	284.5	316.3	318.8	361.5
	69	198.1	259.1	274.3	390.7	400.4	412.8	451.9
	70	102.9	169.4	212.8	223.0	226.8	275.0	323.3
	71	80.3	130.6	181.4	220.8	237.4	308.2	383.1
	72	122.9	122.9	135.9	185.7	185.7	230.7	335.9
	73	71.9	83.3	106.2	175.2	200.6	265.3	301.4
	74	127.0	165.1	172.0	198.2	253.3	279.0	382.1
	75	114.6	133.2	196.7	240.4	262.0	290.2	335.8
	76	81.3	102.9	132.1	164.4	176.3	216.1	321.0
	77	182.1	226.1	289.8	430.3	535.7	584.7	706.6
	78	52.3	72.9	96.0	125.2	177.8	200.6	208.2
	79	182.4	290.3	290.3	314.1	347.1	359.5	476.1
	80	119.4	146.1	171.5	194.8	218.2	261.9	365.3
	81	142.2	163.8	176.5	191.8	218.4	258.8	299.5
	82	90.4	90.4	109.5	109.5	111.0	139.4	199.1
	83	88.4	120.1	137.2	168.4	184.1	225.8	320.5
	84	88.9	148.9	221.3	235.3	235.3	249.3	345.8
38								
	64	253.2	307.0	317.4	325.3	325.3	325.3	339.5
	65	130.8	188.0	232.4	263.1	275.0	351.2	422.0
	66	122.2	139.2	155.2	190.0	210.8	252.7	378.7
	67	116.3	131.8	177.5	193.0	232.1	239.7	285.7
	68	80.8	115.3	132.3	186.2	193.0	238.0	286.3
	69	109.5	133.6	143.8	212.8	246.8	314.9	371.0
	70	116.8	159.5	182.1	212.9	226.6	231.8	337.7

Table 2 (Contd.)

Stn. No.	Year	Rainfall in mm. 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
38 (contd.)								
	71	136.4	197.4	238.5	344.2	384.6	436.7	446.9
	72	71.9	112.0	175.8	201.5	201.5	225.6	257.1
	73	94.0	94.0	157.5	171.5	181.6	196.8	311.2
	74	96.5	96.5	107.2	136.9	160.7	197.0	304.2
	75	54.6	100.6	127.8	176.5	203.1	208.9	294.8
	76	108.5	129.3	140.0	171.5	179.4	241.8	341.4
	77	127.0	180.8	206.2	251.4	298.1	339.0	371.0
	78	82.6	106.7	121.2	143.5	159.6	179.7	206.9
	79	185.9	268.7	273.3	276.1	326.6	335.8	396.0
	80	72.1	105.4	122.9	159.5	191.3	213.1	262.9
	81	120.7	159.5	166.9	207.3	215.6	244.6	336.3
	82	77.7	84.8	89.2	93.5	120.7	156.7	193.3
	83	83.3	148.8	176.3	192.5	253.2	274.8	312.4
	84	128.0	181.8	209.5	255.3	267.4	330.1	421.1
4								
	62	114.3	137.2	199.2	226.6	234.2	239.3	386.6
	63	97.0	110.0	116.6	130.1	130.1	160.3	257.3
	64	147.3	176.7	209.7	236.2	244.6	256.8	275.5
	65	129.3	167.7	192.0	335.0	361.4	361.4	425.9
	66	109.2	162.5	168.3	175.9	202.6	230.3	337.6
	67	77.5	100.6	148.1	148.1	153.7	183.9	207.1
	68	68.6	123.9	148.8	194.2	227.3	248.7	263.7
	69	122.7	140.2	178.3	276.5	301.5	365.5	389.1
	70	89.9	133.8	150.6	258.8	329.7	397.9	404.8
	71	88.9	152.4	165.1	210.8	254.0	339.0	379.6
	72	105.4	199.4	236.7	262.1	318.2	318.2	318.2
	73	89.7	126.2	162.3	162.3	229.1	245.8	279.8
	74	96.0	132.8	149.9	158.6	175.8	180.4	266.9
	75	114.3	211.8	276.6	396.0	424.2	444.2	531.4
	76	91.4	109.2	144.8	185.4	202.7	225.3	277.3
	77	101.6	165.1	203.2	278.2	302.4	335.4	365.9
	78	78.7	96.5	154.9	162.5	185.4	198.1	236.2
	79	231.1	459.7	467.4	467.4	497.8	530.9	609.9
	80	76.2	110.5	174.0	212.1	212.1	212.1	250.2

Table 2 (Contd.)

Stn. No.	Year	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
				Rainfall in mm.				
25								
	61	53.3	105.6	132.3	175.3	232.2	271.3	298.0
	62	101.6	106.7	123.7	131.3	146.6	185.7	219.7
	63	55.9	86.4	94.0	128.0	128.0	143.2	203.4
	64	218.4	257.8	293.4	321.3	392.9	392.9	393.7
	65	137.5	157.5	269.3	308.7	322.7	331.3	436.4
	66	74.9	92.5	98.9	103.7	143.5	174.3	214.5
	67	138.7	167.1	195.5	208.4	209.9	214.2	224.3
	68	70.1	72.9	92.7	118.6	136.1	203.9	259.0
	69	108.5	157.5	203.2	259.3	259.3	259.3	297.4
	71	88.9	130.8	166.4	238.8	262.9	343.2	415.6
	72	184.2	189.3	271.8	276.9	301.0	301.0	301.0
	73	120.6	141.7	141.7	162.0	223.2	248.1	254.1
	74	72.1	104.7	126.0	176.3	180.6	190.0	259.8
	75	167.6	233.6	294.6	347.5	369.6	399.6	536.0
	76	101.6	139.7	167.6	189.2	221.2	223.5	319.4
	77	87.6	171.4	177.5	318.5	349.5	382.3	458.2
	78	102.6	102.6	102.6	117.8	124.7	146.0	191.7
	79	243.8	364.5	380.0	385.3	419.9	427.7	444.0
	80	90.2	142.7	177.0	195.1	195.1	200.2	226.8
	81	141.0	191.8	205.7	290.8	291.6	307.6	383.0
	82	77.5	85.3	86.6	94.0	106.2	118.1	131.3
	83	130.8	207.0	217.2	254.3	288.3	336.8	372.4
	84	170.2	302.3	378.5	523.3	523.3	523.3	634.3

Table 3 : Value of $\bar{y}_N$ and σ_N as a function of sample size N

N	$\bar{y}_N$	σ_N	N	$\bar{y}_N$	σ_N
8	0.48430	0.90430	46	0.54680	1.15380
9	0.49020	0.92880	47	0.54730	1.15570
10	0.49520	0.94970	48	0.54770	1.15740
11	0.49960	0.96760	49	0.54810	1.15900
12	0.50350	0.98330	50	0.54854	1.16066
13	0.50700	0.99720	51	0.54890	1.16230
14	0.51000	1.00950	52	0.54930	1.16380
15	0.51280	1.02050	53	0.54970	1.16530
16	0.51570	1.03160	54	0.55010	1.16670
17	0.51810	1.04110	55	0.55040	1.16810
18	0.52020	1.04930	56	0.55080	1.16960
19	0.52200	1.05660	57	0.55110	1.17080
20	0.52355	1.06283	58	0.55150	1.17210
21	0.52520	1.06960	59	0.55180	1.17340
22	0.52680	1.07540	60	0.55208	1.17467
23	0.52830	1.08110	62	0.55270	1.17700
24	0.52960	1.08640	64	0.55330	1.17930
25	0.53086	1.09145	66	0.55380	1.18140
26	0.53200	1.09610	68	0.55430	1.18340
27	0.53320	1.10040	70	0.55477	1.18536
28	0.53430	1.10470	72	0.55520	1.18730
29	0.53530	1.10860	74	0.55570	1.18900
30	0.53622	1.11238	76	0.55610	1.19060
31	0.53710	1.11590	78	0.55650	1.19230
32	0.53800	1.11930	80	0.55688	1.19382
33	0.53880	1.12260	82	0.55720	1.19530
34	0.53960	1.12550	84	0.55760	1.19670
35	0.54034	1.12847	86	0.55800	1.19800
36	0.54100	1.13130	88	0.55830	1.19940
37	0.54180	1.13390	90	0.55860	1.20073
38	0.54240	1.13630	92	0.55890	1.20200
39	0.54300	1.13880	94	0.55920	1.20320
40	0.54362	1.14132	96	0.55952	1.20440
41	0.54420	1.14360	98	0.55980	1.20550
42	0.54480	1.14580	100	0.56002	1.20649
43	0.54530	1.14800	150	0.56461	1.22534
44	0.54580	1.14990	200	0.56715	1.23598
45	0.54630	1.15185	250	0.56878	1.23292

Source: RAUDKIVI,A.J.,Hydrology; Pergamon Press.

Table 4 : Values of χ^2 for degree of freedom ν and probability p

ν	Values of p							
	0.99	0.95	0.80	0.50	0.20	0.10	0.05	0.01
1	0.00	0.00	0.06	0.45	1.60	2.70	3.84	6.63
2	0.02	0.10	0.44	1.38	3.21	4.60	5.99	9.21
3	0.11	0.35	1.00	2.36	4.64	6.25	7.81	11.34
4	0.29	0.71	1.64	3.35	5.98	7.79	9.48	13.27
5	0.55	1.14	2.34	4.35	7.28	9.23	11.07	15.08
6	0.87	1.63	3.07	5.34	8.55	10.64	12.59	16.81
7	1.23	2.16	3.82	6.34	9.80	12.01	14.06	18.47
8	1.64	2.73	4.59	7.34	11.03	13.36	15.50	20.09
9	2.08	3.32	5.38	8.34	12.24	14.68	16.91	21.66
10	2.55	3.94	6.17	9.34	13.44	15.98	18.30	23.20
11	3.05	4.57	6.98	10.34	14.63	17.27	19.67	24.72
12	3.57	5.22	7.80	11.34	15.81	18.54	21.02	26.21
13	4.10	5.89	8.63	12.34	16.98	19.81	22.36	27.68
14	4.66	6.57	9.46	13.33	18.15	21.06	23.68	29.14
15	5.22	7.26	10.30	14.33	10.31	22.30	24.99	30.57
16	5.81	7.96	11.15	15.33	20.46	23.54	26.29	32.00
17	6.40	8.67	12.00	16.33	21.61	24.76	27.58	33.40
18	7.01	9.39	12.85	17.33	22.76	25.98	28.86	34.80
19	7.63	10.11	13.71	18.33	23.90	27.20	30.14	36.19
20	8.26	10.85	14.57	19.33	25.03	28.41	31.41	37.56
21	8.89	11.59	15.44	20.33	26.17	29.61	32.67	38.93
22	9.54	12.33	16.31	21.33	27.30	30.81	33.92	40.28
23	10.19	13.09	17.18	22.33	28.42	32.00	35.17	41.63
24	10.85	13.84	18.06	23.33	29.55	33.19	36.41	42.98
25	11.52	14.61	18.94	24.33	30.67	34.38	37.65	44.31
26	12.19	15.37	19.82	25.33	31.79	35.56	38.88	45.64
27	12.87	16.15	20.00	26.33	32.91	36.74	40.11	46.96
28	13.56	16.92	21.58	27.33	34.02	37.91	41.33	48.27
29	14.25	17.70	22.47	28.33	35.13	39.08	42.55	49.58
30	14.95	18.49	23.36	29.33	36.25	40.25	43.77	50.89

Source : Varshney, R.S.; Engineering Hydrology.

Table 5 : Critical values for the Kolmogorov-Smirnov test Statistic

Sample Size (N)	Significance level 0.20	0.15	0.10	0.05	0.01
1	.900	.925	.950	.975	.995
2	.684	.726	.776	.842	.929
3	.565	.597	.642	.708	.829
4	.494	.524	.564	.624	.734
5	.440	.474	.510	.563	.669
6	.410	.436	.470	.521	.618
7	.381	.405	.438	.486	.577
8	.358	.381	.411	.457	.543
9	.339	.360	.388	.432	.514
10	.322	.420	.388	.409	.486
11	.307	.326	.352	.391	.468
12	.295	.313	.338	.375	.450
13	.284	.302	.325	.361	.433
14	.274	.292	.314	.349	.418
15	.266	.283	.304	.338	.404
16	.258	.274	.295	.328	.391
17	.250	.266	.288	.318	.380
18	.244	.259	.278	.309	.370
19	.237	.252	.272	.301	.361
20	.231	.246	.264	.294	.352
25	.210	.220	.240	.264	.320
30	.190	.200	.220	.242	.290
35	.180	.190	.190	.230	.270
40				.210	.250
50				.190	.230
60				.170	.210
70				.160	.190
80				.150	.180
90				.140	
100				.140	
Asymptotic Formula :	$\frac{1.07}{\sqrt{n}}$	$\frac{1.14}{\sqrt{n}}$	$\frac{1.22}{\sqrt{n}}$	$\frac{1.36}{\sqrt{n}}$	$\frac{1.63}{\sqrt{n}}$

Source : Varshney, R.S.; Engineering Hydrology.

Table 6 : Rainfall depth formulas

Frequency	Formula
5	$d = 0.687\ t^{0.24}$
10	$d = 0.860\ t^{0.23}$
20	$d = 0.915\ t^{0.28}$
25	$d = 1.003\ t^{0.28}$
50	$d = 1.515\ t^{0.28}$
100	$d = 1.312\ t^{0.28}$

Source : Bernard, M.M., 1932

Table 7: PMP design storm value as percent of mean annual rainfall

River Basin	1-day(%)	2-day(%)	3-day(%)
1. Subarnarekha upto ghatshila	26	39	41
2. Betwa upto Rajghat	26	47	64
3. Mahi upto Kanda	42	68	100

Source : Dhar, Rakecha and Mandal.

Table 8 : Difference between the critical value and the computed value of Kolmogorov-Smirnov test for Gamma distribution.

Stn. No.	Difference between critical & Computed Value 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
154	.2286	.1903	.2233	.2680	.2275	.2147	-.6244
23	.1689	.1644	-.6685	-.6596	-.6701	-.6643	-.6621
152	.2479	.2273	.2086	-.5975	-.6000	-.5897	-.5801
222	.2284	.2212	-.6500	-.6522	-.6495	-.6601	-.6508
194	.2241	.2331	.1964	.1665	.2307	.2147	-.6244
210	.1920	.2308	.1849	.2128	-.6501	-.6489	-.6522
181	.2446	.2101	.2218	.1957	.6533	.6488	.6497
209	.0984	.1501	-.6544	-.6644	-.6512	-.6577	-.5364
24	.1210	.1359	.2100	.1895	.1951	.1806	-.6803
165	.1850	.1897	.2419	-.6112	-.6012	-.6102	-.6055
199	.2165	.1577	.2395	.1961	.1676	-.6244	-.6195
203	.1575	.1995	.1839	.2147	.1833	.1438	.1703
8	.1558	.1776	.2137	.2471	.2094	-.6374	-.6401
198	.2121	.2025	.1737	.2279	.2278	-.6112	-.6245
191	.1795	.1674	.2001	.2127	.1908	-.4389	-.6745
219	.1891	.1817	.2009	.2002	-.6745	-.6733	-.6689
185	.1257	.1672	.1046	.1782	-.6624	-.6595	-.6707
182	.1495	.0546	-.6624	-.6678	-.6522	-.6784	-.6148
187	.1607	.2581	.2294	.2157	.2023	-.6164	-.6244
215	.1287	.1931	.2130	-.6374	-.6454	-.6389	-.6313
169	.2117	.1959	.2007	-.6500	-.6432	-.6612	-.6765
156	.1355	.2131	.1808	-.6475	-.6523	-.6589	-.6603
213	.1870	.1866	.1590	-.6400	-.6374	-.6294	-.6256
196	.0973	.0959	-.6624	-.6565	-.6687	-.6709	-.6678
33	.1123	.1607	.1739	.1898	-.6390	-.6502	-.6467
184	.1758	.1734	.1683	.1727	-.6576	-.6622	-.6455
160	-.6639	-.6727	-.6578	-.6654	-.6534	-.6512	-.6737
16	.2106	.2220	.1788	.1924	.1954	-.6244	-.6344
151	.2486	.1909	.2234	.2438	.2076	.2523	-.6112
25	.1657	.1765	.2221	.3245	.6511	-.6511	-.4312

** a negative value indicates a failure

Table 9 : Difference between critical and computed values of Kolmogorov-Smirnov test statistic at 0.05 significance level (Gumbel Distribution).

Stn. No.	Difference between critical & Computed Value						
	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
154	.2527	.2075	.2601	.2343	.2155	.2514	.1739
23	.1473	.1464	.1065	.1214	.1317	.1338	.1973
152	.2703	.2084	.2196	.2429	.2054	.2429	.2660
222	.2018	.1988	.2410	.2213	.1928	.1788	.1827
194	.1832	.2257	.2172	.1706	.2522	.2534	.2090
210	.2152	.2281	.2070	.2480	.2157	.2100	.2025
181	.2495	.2395	.2100	.2224	.2152	.1950	.1646
209	.1189	.1735	.1439	.1732	.2284	.2156	.1673
24	.1175	.1542	.2014	.1790	.2068	.1702	.1972
165	.1444	.1943	.2157	.2169	.1803	.2227	.2400
199	.2105	.1581	.2400	.2136	.1851	.2393	.2321
203	.1713	.2141	.1760	.1973	.1785	.1104	.1388
8	.1640	.1731	.2104	.2750	.2086	.1974	.2159
198	.2509	.2361	.1932	.2271	.2155	.2606	.1910
191	.1904	.1982	.2191	.2113	.2195	.1799	.1936
219	.1777	.1798	.1912	.1819	.1763	.2170	.2117
185	.1175	.1780	.1327	.1859	.2008	.2143	.2125
182	.1565	.0643	.1729	.1110	.1927	.2330	.1526
187	.1922	.2536	.2518	.2488	.2372	.2357	.2280
215	.1590	.2230	.1980	.1042	.0527	.0546	.1233
169	.2431	.2023	.2144	.2184	.2077	.2019	.2348
156	.1454	.2455	.2086	.1570	.2484	.1816	.1874
213	.1755	.1612	.1626	.2365	.2438	.2056	.2206
196	.0833	.1157	.0967	.1203	.1479	.1786	.2058
33	.1091	.1605	.1903	.1969	.2399	.1785	.0654
184	.1775	.1805	.1971	.1909	.1814	.1766	.1686
160	-.0005	.0623	.0611	.1098	.0952	.1341	.1565
16	.2430	.2279	.1948	.2108	.2217	.2055	.2253
151	.2121	.2045	.2497	.2431	.2109	.2291	.2504
25	.1816	.0743	.1803	.1894	.1791	.1912	.2226

** a negative value indicates a failure

Table 10 : Chi-square test with equal probability class interval scheme at 0.05 significance level. (k = 5). (Gamma Distribution).

Stn. No.	Computed 1-Day	Chi-square 2-Day	Values 3-Day	5-Day	7-Day	10-Day	15-Day
199	1.53	10.35*	0.35	2.12	2.71	1.53	0.94
154	0.94	1.53	0.35	0.94	1.53	0.35	5.12
152	1.33	3.33	2.00	2.00	1.33	0.67	3.33
222	2.32	2.00	0.74	1.79	3.89	0.74	1.79
194	1.53	4.47	2.71	5.06	0.35	0.35	2.59
181	0.21	0.21	0.74	1.79	0.74	4.42	0.74
210	3.37	1.79	0.74	0.74	2.32	2.84	2.32
23	4.00	2.57	5.43	5.43	5.43	6.38*	3.52
24	3.30	2.87	4.61	1.13	2.00	1.17	0.26
209	7.58*	3.89	3.37	1.79	1.79	1.79	4.95
165	3.38	2.75	3.38	1.50	4.63	0.25	2.13

Degree of freedom 2

Critical Value 5.99

Values marked with * indicates failure

Table 11 : Chi-square test with equal probability class inteval scheme at 0.05 significance level. (k = 5). (Gumbel Distribution).

Stn. No.	Computed	Chi-square	Values				
	1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
199	1.53	10.35*	1.53	5.06	4.47	3.29	1.53
154	0.35	4.47	0.35	2.71	5.06	0.35	7.47
152	0.67	2.67	7.33	4.67	1.33	0.67	2.67
222	3.37	3.89	1.79	0.74	0.74	1.26	1.26
194	3.88	4.47	2.71	6.24*	1.53	0.35	1.53
181	0.21	0.74	0.21	1.79	1.79	1.26	1.79
210	0.74	0.74	0.74	0.74	1.26	0.21	2.84
23	4.95	3.52	10.19*	5.43	7.33*	6.38*	5.43
24	3.30	8.09*	2.87	2.00	1.13	2.87	0.26
209	6.00*	3.89	2.84	3.37	2.32	0.74	6.00
165	3.38	3.38	2.13	3.38	2.13	2.75	3.38

Degree of freedom 2

Critical Value 5.99

Values marked with * indicates failure

Table 12: Parameters of prediction equation for different stations

Station No.		Value of parameters for different day duration (1)	(2)	(3)	(5)	(7)	(10)	(15)
165								
	U	152.97	204.17	252.40	318.82	363.79	428.65	522.07
	BETA	36.14	58.34	80.50	93.40	98.80	105.73	126.08
220								
	U	162.24	218.59	269.70	348.63	402.62	474.25	612.19
	BETA	49.85	51.24	72.27	72.38	83.47	102.53	119.20
197								
	U	147.42	202.72	245.75	329.44	388.24	452.14	558.93
	BETA	49.92	60.61	69.04	84.93	104.24	119.96	153.32
157								
	U	150.90	210.49	264.06	370.88	449.53	522.40	691.82
	BETA	45.69	64.58	56.42	41.04	64.24	83.68	133.05
161								
	U	159.36	216.18	259.34	327.15	383.84	436.87	507.20
	BETA	29.41	38.53	56.07	64.38	72.10	99.34	106.26
200								
	U	129.77	173.62	221.61	277.55	337.24	417.12	521.24
	BETA	35.21	48.51	77.70	88.29	99.92	118.28	151.12
182								
	U	134.52	181.05	219.93	269.31	304.32	348.16	421.43
	BETA	54.18	76.96	91.60	99.28	111.52	123.23	175.46
159								
	U	153.62	229.03	278.74	368.77	432.01	479.34	601.98
	BETA	32.67	45.13	65.64	94.34	98.98	125.64	157.92
183								
	U	149.02	197.52	240.62	293.56	331.08	386.35	482.21
	BETA	40.99	71.50	80.57	86.26	91.28	96.06	134.61
174								
	U	174.69	240.34	279.50	350.54	393.27	438.47	590.75
	BETA	51.26	64.55	63.76	82.59	108.44	145.92	149.96
177								
	U	140.43	186.49	209.34	268.66	305.35	346.84	422.74
	BETA	59.92	73.08	98.39	113.64	132.12	135.71	182.97
188								
	U	155.54	197.70	230.62	274.29	313.67	377.17	454.45
	BETA	38.80	72.11	89.69	121.32	126.11	138.96	153.15
154								
	U	88.55	129.51	164.70	213.67	246.75	301.35	383.99
	BETA	39.39	41.90	44.55	53.46	60.90	67.46	88.36
160								
	U	140.04	192.69	227.46	273.48	302.93	345.71	427.90
	BETA	34.77	57.44	65.56	86.75	88.33	92.73	85.41

Table 12 (contd.)

Station No.		Value of parameters for different day duration (1)	(2)	(3)	(5)	(7)	(10)	(15)
213								
	U	143.42	189.38	222.29	265.83	302.79	353.15	437.81
	BETA	38.10	47.51	55.21	71.43	84.61	84.69	97.91
167								
	U	145.71	217.98	253.66	312.26	357.94	408.23	497.10
	BETA	41.49	45.13	46.48	57.48	67.31	93.61	107.20
166								
	U	137.40	193.95	235.76	287.94	331.75	388.37	478.49
	BETA	31.26	43.85	61.76	90.15	113.46	121.57	150.27
179								
	U	153.14	192.69	220.46	276.67	309.68	357.43	425.98
	BETA	53.16	57.63	57.51	64.49	55.67	58.57	85.60
209								
	U	181.70	245.26	299.90	358.46	402.52	480.08	585.39
	BETA	53.80	76.34	101.54	104.83	132.99	143.13	184.10
155								
	U	123.16	167.97	196.90	266.93	303.39	353.27	427.92
	BETA	60.75	104.35	109.97	122.74	169.56	181.77	202.70
221								
	U	140.77	197.72	248.82	311.05	376.66	450.60	559.21
	BETA	49.44	65.19	76.19	91.91	92.90	111.18	148.16
199								
	U	104.64	142.97	169.25	208.86	229.60	270.12	346.05
	BETA	42.47	53.19	63.62	83.74	88.92	98.52	133.63
210								
	U	130.19	179.37	212.47	254.85	285.00	319.20	416.39
	BETA	45.76	48.87	62.72	70.75	77.46	82.73	108.70
168								
	U	114.41	145.98	172.55	218.30	242.28	279.09	351.95
	BETA	42.34	48.89	60.70	66.90	78.52	105.73	131.29
189								
	U	113.60	155.69	185.14	234.99	259.68	306.33	389.41
	BETA	49.70	74.43	85.90	91.25	96.40	109.06	128.11
201								
	U	129.08	167.02	193.88	234.47	259.92	294.88	375.30
	BETA	42.74	73.71	82.77	100.85	101.97	109.14	145.67
196								
	U	119.26	154.72	186.65	229.71	254.42	293.98	362.85
	BETA	48.28	66.99	85.69	93.52	94.15	104.72	97.90
203								
	U	111.28	148.91	173.02	208.87	231.70	258.16	328.84
	BETA	26.69	52.42	58.10	56.86	54.24	56.50	77.00
206								
	U	147.24	187.97	212.10	254.47	280.80	316.01	390.33
	BETA	46.19	64.74	76.89	88.36	96.51	103.46	153.37

Table 12 (contd.)

Station No.		Value of parameters for different day duration (1)	(2)	(3)	(5)	(7)	(10)	(15)
153	U	149.37	188.55	207.55	248.12	275.82	316.11	412.62
	BETA	51.96	62.48	75.37	77.57	83.17	91.11	111.30
186	U	155.75	209.31	247.58	305.22	336.82	379.97	478.67
	BETA	42.65	61.93	79.79	99.48	103.04	129.66	172.23
222	U	133.72	188.01	227.04	273.93	317.25	367.06	445.05
	BETA	52.19	67.57	86.11	104.87	110.51	115.10	137.77
215	U	113.86	145.66	165.20	182.10	208.77	248.98	289.82
	BETA	42.03	59.11	68.08	94.57	112.29	145.08	161.31
163	U	121.88	186.43	225.00	276.15	308.29	357.67	434.54
	BETA	41.44	67.99	81.92	98.32	117.33	129.28	160.12
156	U	111.90	162.98	195.50	236.71	273.26	314.34	392.58
	BETA	49.46	72.68	81.83	93.15	93.70	94.78	101.95
181	U	109.12	155.23	177.21	218.00	241.49	270.80	341.61
	BETA	53.57	86.76	100.25	93.00	101.59	121.80	121.75
152	U	105.52	144.62	171.65	201.13	226.69	251.96	309.88
	BETA	42.23	59.46	74.39	87.25	88.26	107.34	134.29
198	U	115.10	149.62	170.77	210.63	232.75	261.97	333.19
	BETA	49.70	62.04	63.56	71.66	87.85	105.90	125.14
187	U	108.26	148.07	176.69	203.89	222.36	258.98	312.95
	BETA	41.34	62.39	63.96	69.83	73.84	90.30	95.22
194	U	86.64	117.17	139.10	167.59	194.63	238.56	300.91
	BETA	51.41	53.17	59.07	62.83	62.65	81.39	93.62
219	U	106.91	140.69	165.78	200.43	222.46	257.24	314.26
	BETA	46.57	50.24	61.03	67.24	74.48	80.02	74.74
158	U	96.91	126.79	150.70	175.45	200.13	234.41	294.67
	BETA	61.08	94.50	103.52	112.82	115.55	126.21	161.60
185	U	100.23	131.26	156.58	185.99	215.39	242.94	301.13
	BETA	55.42	58.60	64.21	79.63	91.08	95.14	101.87
191	U	112.64	147.55	167.01	193.03	218.27	249.96	313.13
	BETA	43.23	50.94	60.57	67.59	75.64	74.42	89.69

Table 12 (contd.)

Station No.		Value of parameters for different day duration (1)	(2)	(3)	(5)	(7)	(10)	(15)
151								
	U	93.87	137.15	165.13	196.79	229.53	259.16	324.98
	BETA	21.93	45.07	51.69	64.79	69.98	71.53	75.81
8								
	U	103.39	134.14	165.82	192.58	220.46	252.95	314.04
	BETA	39.30	52.30	63.33	78.48	83.91	97.66	100.77
24								
	U	104.26	147.76	168.58	204.89	225.28	262.93	312.79
	BETA	29.96	43.08	58.69	64.35	70.53	71.11	82.68
33								
	U	118.86	166.22	201.57	241.70	277.13	308.97	389.94
	BETA	66.05	74.95	67.65	70.96	81.93	88.43	127.00
40								
	U	108.58	149.81	177.31	206.57	236.89	270.15	320.69
	BETA	36.75	56.37	69.91	80.03	82.46	82.12	110.90
16								
	U	108.79	143.11	165.02	197.65	220.35	250.71	304.27
	BETA	43.66	52.47	62.42	72.45	76.41	88.49	113.32
23								
	U	96.15	136.23	159.82	193.15	211.31	240.09	305.63
	BETA	57.82	68.45	83.12	89.02	90.46	91.06	97.78
184								
	U	101.83	130.45	158.79	184.20	202.62	241.38	300.08
	BETA	43.48	63.28	63.00	76.03	88.55	89.83	96.49
38								
	U	91.93	122.26	146.83	178.73	200.27	230.15	295.16
	BETA	39.75	51.98	51.63	55.42	58.70	63.56	61.48
4								
	U	89.46	120.42	155.24	193.43	217.40	240.11	290.27
	BETA	33.21	73.42	70.27	80.82	86.34	91.89	95.78
25								
	U	94.85	126.29	149.34	180.84	201.77	224.89	266.25
	BETA	45.77	66.39	79.11	95.88	97.74	94.73	111.12

Table 13: Maximum rainfall for different return periods

Stn. No.	Day	Return Period in years (2)	(5)	(10)	(20)	(50)	(100)
165							
	1	166.22	207.19	234.31	260.33	294.00	319.24
	2	225.55	291.68	335.46	377.45	431.81	472.55
	3	281.90	373.14	433.55	491.49	566.50	622.71
	5	353.05	458.91	529.00	596.23	683.25	748.47
	7	400.00	511.99	586.13	657.25	749.32	818.31
	10	467.40	587.20	666.50	742.60	841.20	915.00
	15	568.20	711.10	805.80	896.50	1014.00	1102.00
220							
	1	180.51	237.01	274.41	310.29	356.74	391.54
	2	237.37	295.45	333.91	370.79	418.54	454.32
	3	296.19	378.10	432.33	484.36	551.69	602.16
	5	375.16	457.20	511.52	563.62	631.06	681.61
	7	433.21	527.81	590.45	650.53	728.30	786.58
	10	511.80	628.00	704.90	778.70	874.30	945.90
	15	655.80	790.90	880.40	966.20	1077.30	1160.50
197							
	1	165.71	222.29	259.75	295.68	342.18	377.04
	2	224.93	293.63	339.11	382.74	439.22	481.54
	3	271.06	349.31	401.12	450.81	515.14	563.34
	5	360.57	456.84	520.58	581.72	660.86	720.16
	7	426.45	544.60	622.83	697.87	795.00	867.79
	10	496.10	632.00	722.10	808.40	920.20	1003.90
	15	615.10	788.90	903.90	1014.30	1157.10	1264.20
157							
	1	167.64	219.43	253.72	286.61	329.19	361.09
	2	234.16	307.35	355.81	402.30	462.47	507.56
	3	284.74	348.69	391.03	431.64	484.21	523.60
	5	385.92	432.44	463.23	492.77	531.01	559.67
	7	473.08	545.89	594.10	640.34	700.19	745.05
	10	553.00	647.90	710.70	770.90	848.90	907.30
	15	740.50	891.30	991.20	1087.00	1210.90	1303.90
161							
	1	170.15	203.49	225.56	246.73	274.14	294.68
	2	230.31	273.98	302.90	330.64	366.54	393.45
	3	279.89	343.44	385.52	425.87	478.12	517.26
	5	350.74	423.71	472.02	518.36	578.34	623.30
	7	410.27	491.98	546.09	597.99	665.16	715.50
	10	473.20	585.80	660.40	731.90	824.40	893.80
	15	546.10	666.50	746.30	822.80	921.80	996.00

Table 13 (contd.)

Stn. No.	Day	(2)	(5)	(10)	(20)	(50)	(100)
		Return Period in years					
200							
	1	142.67	182.58	209.00	234.34	267.14	291.72
	2	191.40	246.38	282.78	317.70	362.89	396.76
	3	250.09	338.16	396.47	452.40	524.80	579.06
	5	309.91	409.98	476.24	539.79	622.06	683.71
	7	373.87	487.12	562.11	634.03	727.14	796.91
	10	460.40	594.50	683.30	768.40	878.60	961.20
	15	576.60	747.90	861.30	970.00	1110.80	1216.40
182							
	1	154.38	215.79	256.45	295.46	345.94	383.77
	2	209.26	296.49	354.24	409.64	481.35	535.09
	3	253.50	357.32	426.06	491.99	577.33	641.29
	5	305.70	418.23	492.74	564.21	656.71	726.04
	7	345.20	471.60	555.29	635.56	739.48	817.35
	10	393.30	533.00	625.40	714.10	829.00	915.00
	15	485.70	684.60	816.20	942.50	1106.00	1228.50
159							
	1	165.60	202.62	227.14	250.65	281.09	303.90
	2	245.57	296.72	330.59	363.08	405.13	436.65
	3	302.80	377.20	426.46	473.71	534.88	580.71
	5	403.35	510.28	581.07	648.98	736.89	802.76
	7	468.29	580.48	654.76	726.01	818.24	887.36
	10	525.30	667.70	762.00	852.50	969.50	1057.30
	15	659.80	838.80	957.30	1071.00	1218.10	1328.40
183							
	1	164.04	210.50	241.25	270.76	308.95	337.56
	2	223.73	304.76	358.42	409.88	476.50	526.43
	3	270.15	361.47	421.93	479.93	555.00	611.26
	5	325.18	422.95	487.69	549.78	630.16	690.39
	7	364.54	468.00	536.50	602.20	687.25	750.99
	10	421.50	530.40	602.50	671.60	761.10	828.20
	15	531.50	684.10	785.10	882.00	1007.40	1101.40
174							
	1	193.47	251.58	290.05	326.95	374.71	410.51
	2	264.00	337.16	385.60	432.07	492.21	537.29
	3	302.87	375.13	422.98	468.87	528.28	572.79
	5	380.81	474.42	536.40	595.85	672.81	730.48
	7	433.02	555.92	637.30	715.35	816.39	892.11
	10	491.90	657.30	766.80	871.80	1007.80	1109.70
	15	645.70	815.60	928.20	1036.10	1175.80	1280.50

Table 13 (contd.)

Stn. No.	Day	Return Period in years (2)	(5)	(10)	(20)	(50)	(100)
177							
	1	162.40	230.31	275.28	318.41	374.24	416.08
	2	213.28	296.11	350.95	403.56	471.66	522.69
	3	245.40	356.91	430.75	501.57	593.25	661.95
	5	310.32	439.12	524.40	606.21	712.09	791.45
	7	353.77	503.52	602.67	697.77	820.88	913.13
	10	396.50	550.40	652.20	749.90	876.30	971.10
	15	489.80	697.10	834.40	966.10	1136.60	1264.40
188							
	1	169.76	213.75	242.87	270.80	306.96	334.05
	2	224.13	305.87	359.98	411.89	479.08	529.44
	3	263.49	365.14	432.45	497.00	580.57	643.19
	5	318.75	456.26	547.30	634.63	747.66	832.37
	7	359.89	502.83	597.47	688.25	805.75	893.81
	10	428.10	585.60	689.80	789.90	919.30	1016.40
	15	510.50	684.10	799.10	909.30	1052.00	1158.90
154							
	1	102.99	147.64	177.19	205.55	242.25	269.75
	2	144.86	192.35	223.79	253.95	292.99	322.24
	3	181.03	231.52	264.95	297.02	338.53	369.63
	5	233.26	293.85	333.97	372.45	422.26	459.59
	7	269.07	338.09	383.80	427.63	484.38	526.90
	10	326.00	402.50	453.10	501.70	564.50	611.60
	15	416.30	516.50	582.80	646.40	728.70	790.40
160							
	1	152.79	192.20	218.29	243.32	275.72	299.99
	2	213.74	278.84	321.94	363.29	416.80	456.91
	3	251.49	325.80	375.00	422.19	483.28	529.06
	5	305.27	403.60	468.69	531.14	611.97	672.54
	7	335.30	435.42	501.71	565.29	647.60	709.28
	10	379.60	484.70	554.30	621.10	707.50	772.20
	15	459.20	556.00	620.10	681.50	761.10	820.80
213							
	1	157.38	200.57	229.16	256.59	292.09	318.70
	2	206.79	260.65	296.30	330.50	374.77	407.95
	3	242.52	305.09	346.52	386.26	437.69	476.24
	5	292.01	372.97	426.57	477.99	544.54	594.42
	7	333.80	429.70	493.19	554.09	632.93	692.00
	10	384.10	480.10	543.70	604.60	683.50	742.70
	15	473.60	584.60	658.10	728.60	819.80	888.20

Table 13 (contd.)

Stn. No.	Day	Return Period in years (2)	(5)	(10)	(20)	(50)	(100)
167							
	1	160.91	207.94	239.08	268.94	307.60	336.57
	2	234.52	285.67	319.53	352.01	394.06	425.57
	3	270.70	323.38	358.26	391.71	435.02	467.48
	5	333.33	398.48	441.62	482.99	536.55	576.69
	7	382.61	458.90	509.41	557.86	620.58	667.58
	10	442.50	548.60	618.90	686.20	773.50	838.80
	15	536.30	657.90	738.30	815.50	915.30	990.20
166							
	1	148.85	184.29	207.75	230.26	259.39	281.22
	2	210.02	259.73	292.63	324.20	365.06	395.68
	3	258.39	328.40	374.75	419.21	476.76	519.88
	5	320.98	423.15	490.80	555.69	639.69	702.63
	7	373.33	501.94	587.08	668.76	774.48	853.71
	10	432.90	570.70	661.90	749.40	862.70	947.60
	15	533.50	703.80	816.60	924.80	1064.80	1169.70
179							
	1	172.62	232.88	272.77	311.04	360.57	397.69
	2	213.81	279.14	322.39	363.87	417.57	457.82
	3	241.53	306.72	349.87	391.27	444.86	485.01
	5	300.31	373.40	421.80	468.22	528.31	573.34
	7	330.08	393.18	434.96	475.03	526.91	565.78
	10	378.90	445.20	489.20	531.40	585.90	626.80
	15	457.30	554.30	618.60	680.20	760.00	819.70
209							
	1	201.42	262.40	302.77	341.49	391.62	429.19
	2	273.24	359.77	417.05	472.00	543.13	596.43
	3	337.11	452.19	528.39	601.48	696.08	766.98
	5	396.88	515.69	594.36	669.82	767.49	840.69
	7	451.26	602.00	701.80	797.53	921.45	14.31
	10	532.50	694.70	802.10	905.20	1038.50	1138.50
	15	652.80	861.50	999.60	1132.20	1303.70	1432.30
155							
	1	145.42	214.27	259.86	303.58	360.19	402.60
	2	206.22	324.49	402.79	477.90	575.13	647.99
	3	237.21	361.85	444.38	523.54	626.01	702.80
	5	311.92	451.03	543.14	631.49	745.86	831.56
	7	365.54	557.73	684.97	807.03	965.02	83.42
	10	419.90	625.90	762.30	893.10	1062.50	1189.40
	15	502.20	731.90	884.00	1029.90	1218.80	1360.30

Table 13 (contd.)

Stn. No.	Day	(2)	(5)	(10)	(20)	(50)	(100)
		Return Period in years					
221							
	1	158.89	214.92	252.02	287.61	333.67	368.19
	2	221.61	295.49	344.41	391.33	452.07	497.59
	3	276.75	363.11	420.28	475.13	546.12	599.32
	5	344.73	448.91	517.89	584.05	669.69	733.87
	7	410.71	516.01	585.73	652.61	739.17	804.05
	10	491.30	617.30	700.70	780.80	884.40	962.00
	15	613.50	781.40	892.60	999.20	1137.30	1240.70
199							
	1	120.20	168.34	200.21	230.78	270.35	300.00
	2	162.47	222.75	262.67	300.96	350.52	387.66
	3	192.56	264.67	312.41	358.20	417.48	461.90
	5	239.55	334.46	397.29	457.57	535.59	594.06
	7	262.19	362.97	429.70	493.70	576.55	638.63
	10	306.20	417.80	491.80	562.70	654.50	723.30
	15	395.00	546.40	646.70	742.90	867.40	960.70
210							
	1	146.96	198.83	233.17	266.11	308.76	340.71
	2	197.28	252.67	289.34	324.52	370.05	404.17
	3	235.46	306.55	353.61	398.76	457.20	501.00
	5	280.78	360.97	414.06	464.98	530.90	580.30
	7	313.39	401.19	459.31	515.07	587.24	641.33
	10	349.50	443.30	505.30	564.90	642.00	699.80
	15	456.20	579.40	661.00	739.20	840.50	916.40
168							
	1	129.93	177.92	209.69	240.17	279.62	309.19
	2	163.90	219.31	256.00	291.20	336.75	370.89
	3	194.80	263.59	309.14	352.83	409.39	451.77
	5	242.82	318.65	368.86	417.02	479.35	526.07
	7	271.06	360.05	418.97	475.49	548.65	603.47
	10	317.80	437.60	517.00	593.10	691.60	765.40
	15	400.00	548.80	647.40	741.90	864.20	955.90
189							
	1	131.81	188.14	225.43	261.20	307.51	342.21
	2	182.96	267.32	323.18	376.76	446.11	498.08
	3	216.62	313.98	378.45	440.28	520.32	580.30
	5	268.43	371.86	440.33	506.02	591.04	654.76
	7	295.02	404.28	476.62	546.02	635.84	703.16
	10	346.30	469.90	551.70	630.20	731.90	808.00
	15	436.30	581.50	677.70	769.90	889.30	978.70

Table 13 (contd.)

Stn. No.	Day	Return Period in years (2)	(5)	(10)	(20)	(50)	(100)
201							
	1	144.74	193.19	225.26	256.03	295.85	325.70
	2	194.04	277.58	332.89	385.95	454.63	506.09
	3	224.22	318.04	380.15	439.74	516.86	574.66
	5	271.43	385.74	461.43	534.02	627.99	698.41
	7	297.29	412.87	489.40	562.80	657.82	729.02
	10	334.80	458.50	540.40	619.00	720.70	796.90
	15	428.60	593.70	703.10	807.90	943.70	1045.40
196							
	1	136.95	191.68	227.91	262.66	307.65	341.36
	2	179.27	255.20	305.47	353.70	416.12	462.90
	3	218.06	315.18	379.48	441.16	521.01	580.84
	5	263.98	369.98	440.16	507.47	594.61	659.90
	7	288.92	395.63	466.28	534.05	621.77	687.51
	10	332.30	451.00	529.60	605.00	702.50	775.70
	15	398.70	509.70	583.10	653.60	744.80	813.20
203							
	1	121.07	151.33	171.36	190.57	215.45	234.09
	2	168.13	227.55	266.89	304.62	353.47	390.08
	3	194.32	260.17	303.77	345.60	399.74	440.31
	5	229.71	294.15	336.82	377.75	430.73	470.44
	7	251.58	313.06	353.76	392.80	443.34	481.21
	10	278.80	342.90	385.30	425.90	478.60	518.00
	15	357.00	444.30	502.10	557.50	629.30	683.00
206							
	1	164.17	216.52	251.19	284.44	327.48	359.73
	2	211.69	285.07	333.66	380.26	440.59	485.79
	3	240.28	327.43	385.14	440.49	512.13	565.82
	5	286.86	387.00	453.31	516.91	599.24	660.93
	7	316.17	425.55	497.97	567.44	657.36	724.75
	10	353.90	471.10	548.80	623.30	719.70	791.90
	15	446.50	620.30	735.40	845.80	988.70	1095.80
153							
	1	168.42	227.30	266.29	303.69	352.10	388.38
	2	211.45	282.27	329.16	374.14	432.35	475.98
	3	235.17	320.60	377.15	431.40	501.62	554.25
	5	276.55	364.47	422.69	478.53	550.81	604.97
	7	306.30	400.57	462.98	522.84	600.33	658.40
	10	349.50	452.70	521.10	586.70	671.60	735.20
	15	453.40	579.50	663.00	743.20	846.90	924.60

Table 13 (contd.)

Stn. No.	Day	Return Period in years (2)	(5)	(10)	(20)	(50)	(100)
186							
	1	171.38	219.72	251.73	282.43	322.17	351.95
	2	232.00	302.19	348.66	393.24	450.94	494.18
	3	276.83	367.26	427.14	484.57	558.92	614.63
	5	341.68	454.43	529.08	600.69	693.38	762.84
	7	374.59	491.39	568.71	642.89	738.90	810.85
	10	427.40	574.40	671.70	765.00	885.80	976.40
	15	541.70	737.00	866.20	990.20	1150.70	1270.90
222							
	1	152.85	212.00	251.17	288.73	337.36	373.80
	2	212.77	289.36	340.07	388.71	451.66	498.85
	3	258.60	356.20	420.83	482.81	563.05	623.18
	5	312.36	431.22	509.92	585.41	683.12	756.34
	7	357.75	483.01	565.94	645.49	748.46	825.62
	10	409.20	539.70	626.00	708.90	816.10	896.50
	15	495.50	651.60	755.00	854.20	982.60	1078.80
215							
	1	129.26	176.89	208.43	238.68	277.84	307.19
	2	167.32	234.32	278.69	321.24	376.32	417.59
	3	190.15	267.31	318.40	367.40	430.83	478.37
	5	216.76	323.95	394.91	462.99	551.10	617.13
	7	249.92	377.19	461.45	542.28	646.90	725.31
	10	302.10	466.50	575.40	679.80	815.00	916.30
	15	348.90	531.70	652.80	768.90	919.20	1031.90
163							
	1	137.07	184.04	215.14	244.97	283.59	312.52
	2	211.35	288.42	339.44	388.38	451.73	499.21
	3	255.02	347.88	409.36	468.33	544.66	601.86
	5	312.18	423.61	497.39	568.16	659.77	728.42
	7	351.29	484.28	572.33	656.78	766.11	848.04
	10	405.00	551.50	648.50	741.60	862.10	952.30
	15	493.20	674.70	794.80	910.10	1059.30	1171.10
156							
	1	130.17	186.68	224.09	259.98	306.43	341.24
	2	189.62	272.00	326.54	378.85	446.57	497.32
	3	225.49	318.24	379.64	438.54	514.79	571.92
	5	270.86	376.43	446.34	513.39	600.18	665.23
	7	307.60	413.81	484.12	551.57	638.88	704.31
	10	349.00	456.50	527.60	595.80	684.10	750.30
	15	429.90	545.50	622.00	695.30	790.30	861.50

Table 13 (contd.)

Stn. No.	Day	Return Period in years (2)	(5)	(10)	(20)	(50)	(100)
181							
	1	128.75	189.47	229.67	268.24	318.15	355.56
	2	187.02	285.36	350.47	412.92	493.76	554.34
	3	213.95	327.57	402.80	474.96	568.37	638.36
	5	252.08	357.49	427.27	494.22	580.86	645.80
	7	278.72	393.87	470.10	543.23	637.89	708.83
	10	315.40	453.50	544.90	632.50	746.00	831.10
	15	386.20	524.20	615.50	703.20	816.60	901.60
152							
	1	121.00	168.87	200.56	230.96	270.32	299.80
	2	166.41	233.80	278.42	321.22	376.62	418.14
	3	198.91	283.23	339.06	392.60	461.92	513.86
	5	233.11	332.00	397.47	460.28	541.57	602.50
	7	259.04	359.08	425.31	488.84	571.08	632.70
	10	291.30	412.90	493.50	570.70	670.80	745.70
	15	359.00	511.20	612.00	708.70	833.80	927.60
198							
	1	133.32	189.64	226.94	262.71	309.01	343.71
	2	172.36	242.67	289.22	333.88	391.68	435.00
	3	194.07	266.11	313.80	359.55	418.77	463.15
	5	236.90	318.12	371.90	423.49	490.26	540.30
	7	264.95	364.52	430.44	493.68	575.53	636.87
	10	300.70	420.80	500.20	576.50	675.20	749.10
	15	379.00	520.80	614.80	704.80	821.40	908.80
187							
	1	123.41	170.27	201.29	231.04	269.56	298.42
	2	170.94	241.65	288.47	333.38	391.51	435.08
	3	200.13	272.63	320.62	366.66	426.26	470.92
	5	229.48	308.62	361.03	411.29	476.35	525.11
	7	249.42	333.11	388.52	441.67	510.47	562.03
	10	292.00	394.40	462.10	527.10	611.30	674.30
	15	347.80	455.70	527.20	595.70	684.50	750.90
194							
	1	105.48	163.75	202.32	239.32	287.22	323.12
	2	136.66	196.92	236.82	275.09	324.63	361.75
	3	160.75	227.70	272.02	314.54	369.58	410.82
	5	190.62	261.83	308.98	354.21	412.75	456.62
	7	217.60	288.61	335.62	380.72	439.10	482.84
	10	268.30	360.60	421.70	480.30	556.10	612.90
	15	335.20	441.30	511.50	578.90	666.20	731.60

Table 13 (contd.)

Stn. No.	Day	Return Period in years (2)	(5)	(10)	(20)	(50)	(100)
219							
	1	123.98	176.76	211.71	245.23	288.62	321.13
	2	159.11	216.05	253.75	289.91	336.72	371.80
	3	188.15	257.32	303.12	347.05	403.92	446.53
	5	225.07	301.29	351.75	400.15	462.80	509.75
	7	249.75	334.17	390.06	443.67	513.07	565.07
	10	286.50	377.20	437.30	494.90	569.40	625.30
	15	341.60	426.30	482.40	536.20	605.80	658.00
158							
	1	119.29	188.52	234.36	278.33	335.24	377.89
	2	161.43	268.54	339.45	407.48	495.53	561.52
	3	188.64	305.97	383.66	458.17	554.63	626.91
	5	216.80	344.67	429.33	510.54	615.66	694.43
	7	242.48	373.45	460.16	543.34	651.01	731.69
	10	280.60	423.70	518.40	609.20	726.80	814.90
	15	353.90	537.00	658.30	774.60	925.20	1038.00
185							
	1	120.54	183.36	224.95	264.85	316.49	355.19
	2	152.74	219.16	263.14	305.32	359.92	400.84
	3	180.11	252.89	301.08	347.30	407.13	451.97
	5	215.18	305.43	365.19	422.51	496.71	552.31
	7	248.77	352.01	420.36	485.92	570.79	634.39
	10	277.80	385.60	457.00	525.50	614.10	680.50
	15	338.40	453.90	530.30	603.60	698.60	769.70
191							
	1	128.48	177.48	209.93	241.04	281.33	311.51
	2	166.22	223.95	262.18	298.84	346.30	381.87
	3	189.21	257.86	303.32	346.92	403.36	445.65
	5	217.80	294.41	345.13	393.78	456.76	503.95
	7	246.00	331.73	388.49	442.94	513.41	566.23
	10	277.20	361.50	417.40	471.00	540.30	592.30
	15	346.00	447.60	514.90	579.50	663.10	725.70
151							
	1	101.90	126.76	143.22	159.00	179.44	194.75
	2	153.66	204.74	238.56	271.00	312.99	344.46
	3	184.08	242.67	281.46	318.67	366.83	402.93
	5	220.54	293.98	342.60	389.23	449.60	494.84
	7	255.18	334.50	387.01	437.39	502.59	551.45
	10	285.30	366.40	420.10	471.60	538.20	588.20
	15	352.70	438.60	495.50	550.10	620.70	673.70

Table 13 (contd.)

Stn. No.	Day	Return Period in years (2)	(5)	(10)	(20)	(50)	(100)
8							
	1	117.80	162.34	191.84	220.12	256.74	284.19
	2	153.31	212.59	251.83	289.48	338.21	374.73
	3	189.03	260.81	308.34	353.92	412.93	457.15
	5	221.34	310.29	369.19	425.68	498.80	553.60
	7	251.21	346.32	409.29	469.69	547.88	606.47
	10	288.70	399.40	472.70	543.00	634.00	702.20
	15	350.90	465.10	540.80	613.30	707.20	777.50
24							
	1	115.24	149.19	171.67	193.23	221.15	242.07
	2	163.55	212.38	244.71	275.73	315.87	345.95
	3	190.09	256.60	300.64	342.89	397.57	438.55
	5	228.48	301.42	349.71	396.04	456.00	500.93
	7	251.13	331.07	383.99	434.76	500.47	549.72
	10	289.00	369.60	422.90	474.10	540.40	590.00
	15	343.00	436.80	498.80	558.30	635.40	693.10
33							
	1	143.07	217.93	267.49	315.04	376.58	422.69
	2	193.69	278.64	334.89	388.84	458.68	511.01
	3	226.37	303.05	353.82	402.52	465.56	512.80
	5	267.71	348.14	401.40	452.48	518.60	568.15
	7	307.16	400.03	461.51	520.49	596.83	654.04
	10	341.30	441.60	507.90	571.60	654.00	715.70
	15	436.40	580.40	675.70	767.10	885.50	974.10
40							
	1	122.05	163.71	191.29	217.75	251.99	277.65
	2	170.47	234.36	276.67	317.25	369.77	409.13
	3	202.93	282.17	334.63	384.96	450.10	498.91
	5	235.90	326.61	386.67	444.28	518.85	574.73
	7	267.11	360.57	422.45	481.81	558.64	616.22
	10	300.20	393.30	454.90	514.00	590.50	647.90
	15	361.30	487.00	570.20	650.00	753.40	830.80
16							
	1	124.79	174.28	207.04	238.47	279.15	309.64
	2	162.34	221.81	261.18	298.95	347.84	384.47
	3	187.90	258.64	305.48	350.41	408.57	452.15
	5	224.21	306.33	360.70	412.85	480.36	530.95
	7	248.35	334.96	392.30	447.30	518.50	571.85
	10	283.10	383.40	449.80	513.50	595.90	657.70
	15	345.80	474.20	559.20	640.80	746.40	825.50

Table 13 (contd.)

Stn. No.	Day	(2)	(5)	(10)	(20)	(50)	(100)
		Return Period in years					
23							
	1	117.35	182.88	226.27	267.90	321.77	362.15
	2	161.32	238.90	290.27	339.55	403.33	451.12
	3	190.28	284.49	346.86	406.69	484.14	542.18
	5	225.78	326.68	393.49	457.57	540.52	602.68
	7	244.47	347.00	414.89	480.00	564.29	627.46
	10	273.40	376.60	445.00	510.50	595.30	658.90
	15	341.40	452.30	525.60	596.00	687.10	755.40
184							
	1	117.77	167.05	199.68	230.98	271.49	301.86
	2	153.64	225.36	272.85	318.40	377.36	421.55
	3	181.88	253.28	300.56	345.90	404.60	448.59
	5	212.07	298.24	355.29	410.01	480.85	533.94
	7	235.07	335.44	401.89	465.63	548.14	609.98
	10	274.30	376.10	443.50	508.20	591.90	654.60
	15	335.40	444.80	517.20	586.60	676.50	743.90
38							
	1	106.49	151.54	181.37	209.98	247.01	274.76
	2	141.31	200.22	239.23	276.65	325.08	361.38
	3	165.76	224.28	263.03	300.19	348.30	384.35
	5	199.04	261.85	303.44	343.34	394.98	433.67
	7	221.78	288.31	332.36	374.61	429.30	470.29
	10	253.40	325.40	373.10	418.90	478.10	522.50
	15	317.60	387.30	433.50	477.70	535.00	577.90
4							
	1	101.63	139.27	164.19	188.09	219.03	242.22
	2	147.33	230.54	285.64	338.48	406.89	458.15
	3	180.99	260.64	313.37	363.95	429.43	478.49
	5	223.05	314.66	375.30	433.48	508.78	565.21
	7	249.04	346.89	411.68	473.83	554.27	614.56
	10	273.70	377.90	446.90	513.00	598.60	662.80
	15	325.30	433.90	505.80	574.70	663.90	730.80
25							
	1	111.62	163.50	197.84	230.79	273.43	305.39
	2	150.62	225.87	275.69	323.47	385.33	431.68
	3	178.34	268.01	327.38	384.33	458.04	513.29
	5	215.98	324.66	396.61	465.62	554.96	621.91
	7	237.59	348.38	421.73	492.08	583.16	651.41
	10	259.60	366.90	438.00	506.20	594.50	660.60
	15	306.90	432.90	516.30	596.30	699.80	777.40

Table 14 : Value of rainfall correction factors for different return periods

Station No.	Return Period in Years (2)	(5)	(10)	(20)	(50)	(100)
165	0.83	0.83	0.82	0.81	0.79	0.78
220	0.90	0.87	0.86	0.84	0.81	0.79
197	0.85	0.86	0.86	0.85	0.83	0.82
157	0.93	0.88	0.85	0.32	0.78	0.74
161	0.83	0.79	0.76	0.74	0.71	0.69
200	0.76	0.78	0.78	0.77	0.76	0.75
182	0.73	0.80	0.82	0.83	0.83	0.83
159	0.92	0.90	0.87	0.84	0.80	0.79
183	0.79	0.80	0.80	0.79	0.78	0.77
174	0.92	0.92	0.91	0.90	0.88	0.86
177	0.74	0.82	0.85	0.87	0.87	0.88
188	0.78	0.83	0.85	0.85	0.85	0.85
154	0.55	0.56	0.55	0.55	0.54	0.53
160	0.72	0.72	0.71	0.71	0.69	0.68
213	0.72	0.71	0.70	0.69	0.67	0.65
167	0.80	0.77	0.74	0.72	0.69	0.68
166	0.77	0.77	0.77	0.76	0.75	0.74
179	0.73	0.71	0.71	0.69	0.67	0.65
209	0.97	1.00	1.00	1.00	0.98	0.97
155	0.74	0.86	0.91	0.94	0.96	0.97
221	0.84	0.85	0.85	0.84	0.82	0.81
199	0.57	0.62	0.63	0.64	0.64	0.64
210	0.68	0.69	0.68	0.68	0.66	0.65
168	0.59	0.62	0.63	0.63	0.63	0.62
189	0.64	0.70	0.72	0.73	0.73	0.73
201	0.65	0.71	0.73	0.74	0.74	0.74
196	0.63	0.68	0.69	0.70	0.68	0.67
203	0.56	0.55	0.55	0.54	0.52	0.51
206	0.70	0.74	0.75	0.76	0.75	0.74
153	0.70	0.72	0.72	0.72	0.71	0.71
186	0.81	0.83	0.84	0.84	0.83	0.82
222	0.75	0.79	0.81	0.81	0.81	0.80
215	0.56	0.63	0.66	0.68	0.69	0.70
163	0.73	0.78	0.79	0.80	0.80	0.79
156	0.65	0.70	0.71	0.72	0.72	0.71
181	0.61	0.69	0.72	0.74	0.75	0.75
152	0.56	0.62	0.64	0.65	0.65	0.66
198	0.58	0.63	0.65	0.65	0.65	0.65
187	0.56	0.59	0.60	0.61	0.61	0.60
194	0.48	0.53	0.54	0.55	0.56	0.56
219	0.54	0.57	0.58	0.57	0.57	0.56
158	0.54	0.67	0.72	0.75	0.77	0.78
185	0.53	0.59	0.61	0.62	0.62	0.63
191	0.55	0.57	0.58	0.58	0.58	0.57

Table 14 (contd.)

Station No.	Return Period in Years (2)	(5)	(10)	(20)	(50)	(100)
151	0.53	0.53	0.53	0.53	0.52	0.51
8	0.54	0.58	0.59	0.60	0.60	0.60
24	0.55	0.55	0.55	0.55	0.54	0.54
33	0.66	0.70	0.71	0.72	0.73	0.72
40	0.57	0.61	0.62	0.62	0.62	0.62
16	0.55	0.58	0.60	0.60	0.60	0.60
23	0.54	0.61	0.63	0.63	0.63	0.63
184	0.52	0.57	0.59	0.60	0.60	0.60
38	0.48	0.50	0.51	0.51	0.48	0.48
4	0.51	0.57	0.59	0.60	0.60	0.60
25	0.51	0.58	0.61	0.63	0.64	0.64

Table 15: Ratios of 5,10,20,50 and 100 year to 2-year different duration rainfall over N-W region of Bangladesh

Hydologocal Unit No.		Return Period (years)				
		(5)	(10)	(20)	(50)	(100)
1	Mean	1.30	1.50	1.68	1.93	2.11
	S.D	0.08	0.14	0.19	0.26	0.31
2	Mean	1.33	1.55	1.76	2.04	2.25
	S.D	0.07	0.11	0.16	0.21	0.26
3	Mean	1.38	1.63	1.86	2.18	2.41
	S.D	0.06	0.10	0.14	0.19	0.23
4	Mean	1.37	1.62	1.86	2.17	2.40
	S.D	0.06	0.10	0.14	0.19	0.23
5	Mean	1.33	1.55	1.76	2.03	2.23
	S.D	0.04	0.06	0.08	0.11	0.14
6	Mean	1.57	1.95	2.32	2.79	3.14
	S.D	0.05	0.08	0.12	0.16	0.20
7	Mean	1.40	1.67	1.92	2.26	2.50
	S.D	0.07	0.12	0.16	0.22	0.26

Table 16: Percentage of error calculated by using the nomograph and the correction factors

Stn. No.	Day	Return period in Years (2)	(5)	(10)	(20)	(50)	(100)
161							
	1	3.2	3.1	4.3	5.5	6.3	6.3
	2	1.5	3.3	4.3	5.7	6.7	6.9
	3	2.2	1.8	2.6	2.5	2.7	3.2
	5	1.2	0.7	1.2	0.4	0.1	0.2
	7	1.3	1.1	1.4	0.5	0.2	0.3
	10	0.8	3.1	5.2	5.3	5.9	6.5
	15	5.3	1.4	0.3	0.0	0.0	0.3
183							
	1	4.4	0.9	2.7	2.6	3.6	3.5
	2	3.5	5.9	7.2	8.9	9.7	10.7
	3	3.6	5.5	6.3	7.6	7.9	8.6
	5	1.4	0.7	0.6	0.2	0.7	0.5
	7	5.6	5.2	5.5	5.5	6.5	6.6
	10	7.7	8.3	9.4	10.1	11.9	12.5
	15	3.0	0.0	0.2	0.4	0.4	0.6
198							
	1	13.6	11.6	11.3	12.9	13.6	14.1
	2	8.0	6.9	6.5	8.0	8.5	8.8
	3	1.5	1.0	2.3	1.4	1.6	1.7
	5	2.2	5.4	7.2	7.0	7.8	8.4
	7	6.7	6.4	6.9	5.9	6.0	6.1
	10	10.8	7.5	7.0	5.5	5.1	5.0
	15	6.0	3.5	3.5	2.5	2.7	2.9

Table 17: Percentage of error calculated by using N-W regional curve

Stn. No.	Day	(2)	(5)	(10)	(20)	(50)	(100)
			Return period in Years				
155							
	1	2.8	9.8	13.0	14.6	15.9	16.5
	2	2.8	15.6	20.4	23.1	25.3	26.5
	3	2.7	12.9	17.0	19.3	21.1	22.1
	5	2.7	8.2	10.7	12.0	13.0	13.4
	7	2.7	12.9	17.0	19.3	21.1	22.1
	10	2.7	10.9	14.3	16.2	17.7	18.5
	15	2.7	8.8	11.6	13.1	14.2	14.7
177							
	1	2.7	6.3	8.2	9.1	9.7	9.9
	2	2.8	4.3	5.6	5.8	5.9	5.8
	3	2.7	8.9	11.3	12.8	13.9	14.4
	5	2.8	6.1	8.0	8.9	9.3	9.5
	7	2.7	6.7	8.6	9.6	10.3	10.6
	10	2.5	4.3	5.5	5.8	5.8	6.1
	15	2.8	6.7	8.7	9.7	10.2	10.6
165							
	1	2.7	6.5	10.2	13.7	17.6	20.1
	2	2.4	2.6	4.5	6.4	8.8	10.1
	3	2.8	0.3	1.1	2.1	3.4	4.4
	5	2.5	2.1	3.6	5.4	7.4	8.8
	7	2.7	3.7	5.9	8.3	11.0	12.8
	10	2.7	5.5	9.0	12.1	15.5	17.8
	15	2.8	7.4	9.5	15.5	16.6	18.9

Table 18: Comparison of predicted 2-year rainfall from three diffrerent methods

Stn. No.	No. of Days	Freq. Anal.	Nomograph Method	N-W Region	MPO Hyd. Unit
165	1	166.2	164.6	170.9	161.3
220	2	237.8	245.9	244.6	230.8
197	3	271.0	280.1	278.8	263.0
157	5	385.9	388.1	396.9	374.5
200	7	373.8	370.5	384.5	384.3
182	10	393.3	419.6	404.5	404.3
159	15	659.8	637.8	678.7	678.2
183	1	164.0	156.7	168.7	168.6
187	2	170.9	153.0	175.8	176.3
194	3	160.7	158.2	165.3	165.8
181	5	252.0	254.5	259.2	258.9
152	7	259.0	273.0	266.4	266.0
24	10	289.0	316.1	297.2	296.9
40	15	361.6	395.8	371.9	371.5
158	1	119.2	107.1	122.6	125.0
4	2	147.3	139.4	151.5	152.0
25	3	178.3	168.1	183.4	184.0

Table 19: Comparison of predicted 5-year rainfall
from three different methods

Stn. No.	No. of Days	Freq. Anal.	Nomograph Method	N-W Region	MPO Hyd. Unit
161	1	203.5	209.8	226.0	217.0
213	2	260.6	254.4	274.6	263.7
166	3	328.4	328.7	343.2	329.6
179	5	373.4	377.9	398.8	383.0
174	7	555.9	566.4	575.1	570.6
177	10	550.4	588.9	526.7	522.6
188	15	684.1	710.2	678.1	672.8
154	1	147.6	148.7	136.8	135.7
219	2	216.0	204.2	211.3	216.2
185	3	252.8	286.0	239.2	244.8
8	5	310.3	308.7	294.3	299.7
33	7	400.0	430.9	407.9	415.4
24	10	369.8	395.0	383.8	379.7
40	15	487.0	522.0	479.9	474.8
158	1	188.5	177.9	158.4	184.3
16	2	221.8	207.8	215.6	224.3
23	3	284.5	260.4	252.7	262.9

Table 20: Comparison of predicted 10-year rainfall from three different methods

Stn. No.	No. of Days	Freq. Anal.	Nomograph Method	N-W Region	MPO Hyd. Unit
155	1	259.8	281.8	226.1	219.0
221	2	344.4	353.4	344.5	333.8
168	3	309.1	311.1	302.8	293.4
189	5	440.3	441.8	417.3	404.3
196	7	466.2	488.5	449.2	444.1
203	10	385.3	453.1	433.6	428.6
206	15	735.4	734.1	694.3	686.4
153	1	256.3	222.9	261.8	258.9
187	2	288.4	249.4	265.7	274.7
194	3	272.0	266.7	249.9	258.3
198	5	371.9	398.9	368.3	378.6
191	7	388.5	410.6	382.5	393.2
24	10	422.9	453.1	449.3	442.5
40	15	570.2	606.9	561.8	553.2
158	3	383.6	355.6	293.3	362.6
184	5	355.3	362.1	329.7	349.2
38	7	332.3	361.1	344.8	365.2

Table 21: Comparison of redicted 20-year rainfall from three different methods

Stn. No.	No. of Days	Freq. Anal.	Nomograph Method	N-W Region	MPO Hyd. Unit
220	10	778.8	786.3	911.8	889.2
197	15	1014.3	945.3	1095.8	1068.6
161	1	246.7	260.3	303.1	295.6
213	2	330.5	325.9	368.4	359.2
174	3	468.8	505.0	539.5	531.9
177	5	606.2	606.6	552.8	545.0
188	7	688.2	683.7	641.1	632.1
154	10	501.7	514.8	580.9	572.7
187	15	595.7	678.4	619.7	645.2
194	1	239.3	193.5	187.9	195.6
198	2	333.8	307.0	307.0	317.9
151	3	318.6	297.4	327.9	339.5
24	5	396.0	383.5	407.0	399.4
40	7	481.8	498.7	475.8	466.9
158	10	609.2	702.0	505.3	652.0
4	15	574.7	667.3	579.6	621.9
25	1	230.8	226.5	198.8	213.3

Table 22: Comparison of predicted 50-year rainfall from three different methods

Stn. No.	No. of Days	Freq. Anal.	Nomograph Method	N-W Region	MPO Hyd. Unit
179	3	444.8	438.7	502.6	493.3
209	5	767.5	797.3	825.9	810.5
155	7	965.0	901.1	760.7	746.5
221	10	884.4	895.7	1022.5	1003.5
199	15	867.4	830.6	822.1	808.3
210	1	308.7	270.9	305.8	300.7
196	2	416.1	374.8	373.0	366.8
222	3	563.0	530.4	538.2	529.2
194	5	412.7	455.6	396.7	416.0
219	7	513.0	535.0	519.7	545.1
181	10	746.0	819.2	656.4	684.4
152	15	833.8	843.5	747.3	779.1
24	1	221.1	221.7	239.8	234.5
40	2	369.7	402.3	354.7	346.8
158	3	554.6	504.2	392.5	527.5
23	5	540.5	512.6	469.8	510.6
184	7	548.1	563.2	489.2	531.6

Table 23: Comparison of predicted 100-year rainfall from three different methods

Stn. No.	No. of Days	Freq. Anal.	Nomograph Method	N-W Region	MPO Hyd. Unit
165	15	1102.0	1122.5	1311.4	1291.8
197	1	377.0	372.3	382.4	376.7
157	2	507.5	451.4	477.1	532.3
189	3	580.3	529.2	499.9	492.4
196	5	659.9	603.8	609.2	598.1
203	7	481.2	530.5	580.6	570.0
206	10	791.9	896.0	816.8	801.9
186	15	1270.9	1180.1	1250.3	1227.5
187	1	298.4	272.4	284.8	299.9
185	2	400.8	384.3	352.5	371.2
33	3	512.8	522.0	522.4	546.8
151	5	494.8	459.6	508.9	532.8
24	7	606.4	561.7	579.5	565.5
40	10	647.9	750.7	692.9	676.1
158	15	1038.0	1122.5	816.7	1122.9
38	1	274.7	217.9	243.4	266.5
25	2	431.6	366.0	347.6	380.5

Table 24 : Values of K_M and PMP of selected stations

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
165					
	1	7.19	1.67	4.0	13.88
	2	9.82	2.91	5.0	24.37
	3	12.23	3.83	4.5	29.47
	5	15.43	4.78	3.5	32.16
	7	17.54	5.21	3.8	37.32
	10	20.25	5.02	3.7	38.81
	15	24.75	6.36	4.4	52.75
220					
	1	7.73	2.28	3.1	14.79
	2	10.08	2.08	4.8	20.05
	3	12.54	2.76	4.1	23.85
	5	16.04	3.42	3.0	26.30
	7	18.53	3.96	3.1	30.81
	10	21.87	4.75	2.9	35.65
	15	28.26	6.18	6.8	50.49
197					
	1	7.12	2.34	4.2	16.95
	2	9.69	2.97	5.0	24.54
	3	11.72	3.51	4.9	28.93
	5	15.45	4.00	3.5	29.46
	7	18.17	4.54	3.0	31.79
	10	21.27	5.69	3.2	39.50
	15	26.33	7.10	4.0	54.74
157					
	1	7.14	1.82	4.2	14.77
	2	9.97	2.57	4.8	22.32
	3	12.15	2.36	4.7	23.24
	5	16.54	1.98	2.6	21.68
	7	20.32	3.15	2.1	26.93
	10	23.65	3.69	2.3	32.12
	15	31.60	5.51	2.8	47.02
161					
	1	7.34	1.43	3.9	12.90
	2	9.88	1.68	4.9	18.13
	3	12.10	2.78	4.5	24.59
	5	15.16	3.21	3.7	27.05
	7	17.72	3.58	3.6	30.60
	10	20.23	4.03	2.1	28.69
	15	23.54	5.08	4.8	47.93

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
200					
	1	6.09	1.49	5.5	14.30
	2	8.31	2.48	6.6	24.65
	3	10.86	3.89	6.0	34.19
	5	13.46	4.47	5.1	36.24
	7	14.73	4.83	6.0	43.71
	10	16.91	5.82	5.5	48.90
	15	20.71	7.46	5.9	64.71
182					
	1	6.67	2.61	4.7	18.95
	2	9.07	3.78	5.8	31.01
	3	10.84	4.02	5.9	34.53
	5	13.06	4.39	5.5	37.20
	7	14.73	4.83	6.0	43.71
	10	16.91	5.82	5.5	48.90
	15	20.71	7.46	5.9	64.71
159					
	1	7.15	1.61	4.2	13.91
	2	10.61	2.23	4.1	19.74
	3	13.19	3.45	3.6	25.60
	5	17.58	4.94	1.8	26.46
	7	20.26	4.93	2.1	30.62
	10	22.87	6.50	2.9	41.72
	15	28.56	7.78	3.5	55.77
183					
	1	7.06	2.02	4.2	15.53
	2	9.57	3.18	5.3	26.42
	3	11.61	3.82	5.1	31.07
	5	14.00	4.21	4.6	33.37
	7	15.68	4.46	5.0	37.96
	10	18.11	4.70	4.9	41.14
	15	22.90	6.67	5.1	56.94
174					
	1	8.33	2.48	2.7	15.03
	2	11.31	2.99	3.4	21.49
	3	13.04	3.18	3.7	24.82
	5	16.35	3.96	2.8	27.44
	7	18.39	4.31	3.2	32.16
	10	20.97	6.18	3.4	41.97
	15	27.58	6.66	3.8	52.89

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
177					
	1	6.90	2.42	4.3	17.32
	2	9.01	2.68	5.8	24.55
	3	10.27	2.97	6.6	29.87
	5	13.00	3.42	5.4	31.47
	7	14.81	3.86	5.8	37.21
	10	16.67	4.39	5.7	41.70
	15	20.54	5.68	6.0	54.64
188					
	1	7.29	1.91	3.9	14.73
	2	9.54	3.03	5.3	25.62
	3	11.11	3.17	5.5	28.55
	5	13.39	3.95	5.0	33.14
	7	15.20	4.60	5.4	40.05
	10	18.26	5.98	4.8	46.96
	15	22.00	7.44	5.4	62.15
154					
	1	4.42	1.74	8.3	18.84
	2	6.24	1.97	9.4	24.78
	3	7.80	2.15	9.0	27.20
	5	10.03	2.52	8.6	31.71
	7	11.60	2.97	8.4	36.59
	10	14.08	3.38	7.4	39.07
	15	17.77	3.71	7.0	43.74
160					
	1	6.55	1.59	5.0	14.50
	2	9.19	2.66	5.6	24.09
	3	10.80	3.02	5.8	28.32
	5	13.19	4.22	5.6	32.59
	7	14.48	4.32	6.1	40.84
	10	16.35	4.42	5.9	42.40
	15	19.67	3.88	6.3	44.11
213					
	1	6.82	1.98	4.4	15.55
	2	8.85	2.21	6.2	22.56
	3	10.33	2.41	6.4	25.79
	5	12.40	2.93	6.0	29.96
	7	14.26	3.80	6.3	38.21
	10	16.37	3.72	5.9	38.33
	15	20.23	4.50	6.1	47.69

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
167					
	1	6.79	1.41	4.4	13.02
	2	10.06	2.18	4.8	20.52
	3	11.63	2.31	5.0	23.18
	5	14.29	2.78	4.4	26.51
	7	16.39	3.22	4.5	30.86
	10	18.89	4.16	4.4	37.20
	15	23.01	5.17	5.0	48.85
166					
	1	6.40	1.58	5.0	14.31
	2	8.93	1.96	6.1	20.88
	3	11.00	2.74	5.6	26.32
	5	13.66	3.94	4.8	32.56
	7	15.78	4.34	5.0	37.48
	10	18.27	4.49	7.7	39.39
	15	22.44	5.05	5.2	48.71
179					
	1	7.40	2.43	3.8	16.63
	2	9.15	2.61	5.8	24.30
	3	10.36	2.72	6.4	27.77
	5	12.77	2.64	5.7	27.83
	7	14.01	2.13	6.5	27.85
	10	16.12	2.43	6.0	30.72
	15	19.46	3.58	6.4	42.42
209					
	1	8.59	2.34	2.3	18.97
	2	11.68	3.43	3.0	21.97
	3	14.32	4.11	2.8	25.83
	5	16.92	4.58	2.2	26.99
	7	19.39	6.29	2.6	35.75
	10	22.82	6.67	2.5	39.50
	15	27.98	8.53	3.6	58.68
155					
	1	6.39	3.07	5.0	21.74
	2	8.77	4.14	6.1	34.01
	3	10.16	4.61	6.7	41.05
	5	13.48	5.53	5.0	41.15
	7	15.52	6.45	5.2	49.04
	10	17.98	7.54	4.8	54.16
	15	21.84	9.66	5.5	74.96

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
221					
	1	6.83	2.40	4.5	17.62
	2	9.58	3.30	5.3	27.08
	3	11.86	3.65	4.8	29.36
	5	14.85	4.63	4.0	33.37
	7	17.66	4.73	3.6	34.71
	10	21.18	5.76	3.0	38.46
	15	26.35	7.41	4.0	56.00
199					
	1	5.22	2.05	6.9	19.38
	2	7.03	2.49	8.2	27.44
	3	8.35	3.06	8.4	34.06
	5	10.37	3.95	8.2	42.72
	7	11.42	4.40	8.6	49.25
	10	13.26	4.67	7.9	50.13
	15	17.19	6.57	7.3	65.15
210					
	1	6.34	2.22	5.2	17.86
	2	8.70	2.36	6.5	23.79
	3	10.05	2.77	6.7	28.59
	5	12.04	3.33	6.4	33.35
	7	13.40	3.53	6.9	37.78
	10	15.01	4.01	6.8	42.26
	15	19.73	5.59	6.3	54.94
168					
	1	5.55	1.90	6.4	17.70
	2	6.99	2.17	8.3	24.96
	3	8.38	2.93	8.4	33.02
	5	10.33	2.90	8.3	34.38
	7	11.48	3.14	8.5	38.16
	10	13.48	4.28	7.8	46.84
	15	16.97	5.35	7.4	56.59
189					
	1	5.58	1.71	6.3	16.33
	2	7.81	3.04	7.3	30.04
	3	9.35	3.91	7.4	38.30
	5	11.57	4.12	6.8	39.56
	7	12.81	4.68	7.4	47.47
	10	15.10	5.48	6.8	52.34
	15	19.08	6.60	6.4	61.35

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
201					
	1	4.18	1.88	5.5	16.52
	2	8.25	3.00	6.8	28.62
	3	9.58	3.60	7.1	35.16
	5	11.73	4.86	6.8	44.76
	7	12.84	4.94	7.4	49.42
	10	14.45	5.29	7.2	52.54
	15	18.64	7.38	6.8	68.82
196					
	1	5.80	1.89	5.9	16.96
	2	7.66	2.92	7.5	29.60
	3	9.13	2.65	7.6	29.25
	5	11.06	2.83	7.6	32.60
	7	12.13	2.97	8.0	35.91
	10	14.03	3.74	7.4	41.73
	15	16.89	3.75	7.5	45.01
203					
	1	5.19	1.30	6.9	14.16
	2	7.24	2.52	8.0	27.40
	3	8.34	2.72	8.4	31.21
	5	9.88	2.81	8.8	34.57
	7	10.83	2.75	9.2	36.13
	10	11.98	2.83	8.9	37.13
	15	15.21	3.42	8.5	44.25
206					
	1	7.08	2.32	4.1	16.58
	2	9.12	3.17	5.8	27.52
	3	10.31	3.61	6.4	33.41
	5	12.22	3.85	6.2	36.08
	7	13.55	4.51	6.9	44.69
	10	15.19	4.92	6.7	48.16
	15	19.15	7.08	6.4	64.45
153					
	1	7.16	2.10	4.1	15.77
	2	9.07	2.87	5.7	25.42
	3	10.13	3.57	6.7	34.04
	5	11.82	3.43	6.6	34.46
	7	13.10	3.73	7.2	39.93
	10	15.01	4.30	6.8	44.22
	15	19.44	5.21	6.4	52.77

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	P_{MP} (inch)
186					
	1	7.33	1.98	3.9	15.04
	2	9.95	2.91	4.8	23.94
	3	11.81	3.52	4.8	28.71
	5	14.51	4.04	4.2	31.49
	7	15.96	4.06	4.9	37.79
	10	18.34	6.05	4.7	46.78
	15	23.28	8.08	4.9	62.87
222					
	1	6.55	2.35	4.9	18.04
	2	9.18	3.15	5.7	27.07
	3	11.05	3.78	5.7	32.61
	5	13.22	3.97	5.3	34.28
	7	15.24	4.71	5.5	41.17
	10	17.55	5.40	5.2	45.63
	15	21.42	6.94	5.6	60.27
215					
	1	5.57	2.03	6.4	18.56
	2	7.16	2.62	8.0	28.13
	3	8.02	2.42	8.9	29.59
	5	9.11	3.26	9.5	40.07
	7	10.66	4.73	9.3	54.68
	10	12.74	5.34	8.3	57.10
	15	14.67	5.65	8.8	64.35
163					
	1	5.95	2.07	5.6	17.53
	2	9.11	3.21	5.7	27.41
	3	11.05	4.01	5.6	33.52
	5	13.40	4.42	5.0	35.49
	7	15.08	5.29	5.6	44.69
	10	17.46	6.09	5.2	49.15
	15	21.13	7.06	5.7	61.35
156					
	1	5.54	2.05	6.3	18.45
	2	8.09	3.11	7.0	29.88
	3	9.73	3.91	7.3	38.29
	5	11.66	4.40	7.0	42.46
	7	13.24	4.49	7.1	45.14
	10	15.07	4.73	6.8	47.24
	15	17.37	4.93	7.3	53.35

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
181					
	1	5.51	2.35	6.3	20.33
	2	7.96	3.54	7.2	33.42
	3	9.21	4.54	7.6	43.61
	5	10.83	4.26	7.6	43.19
	7	11.95	4.58	8.2	49.49
	10	13.53	5.44	7.7	55.20
	15	16.52	5.44	7.7	58.43
152					
	1	4.81	1.92	7.6	19.41
	2	7.10	2.48	8.2	27.42
	3	8.54	3.31	8.3	36.00
	5	9.94	3.62	8.7	41.46
	7	11.10	3.90	8.9	45.81
	10	12.43	4.48	8.6	50.98
	15	15.33	5.63	8.4	62.61
198					
	1	5.82	2.45	5.9	20.24
	2	7.54	3.13	7.6	31.33
	3	8.48	3.18	8.3	34.90
	5	10.36	3.65	8.1	39.92
	7	11.61	4.48	8.5	49.72
	10	13.10	5.17	8.0	54.43
	15	16.43	5.89	7.8	62.35
187					
	1	5.37	2.09	6.7	19.38
	2	7.33	2.75	7.9	29.08
	3	8.62	2.99	8.1	32.82
	5	9.90	3.32	8.7	38.74
	7	10.73	3.42	9.2	42.15
	10	12.51	3.96	8.5	46.13
	15	14.93	4.34	8.7	52.69
194					
	1	4.41	1.58	8.3	17.51
	2	5.80	2.06	9.8	26.01
	3	6.90	2.63	10.1	33.50
	5	8.21	2.93	10.5	38.94
	7	9.39	3.01	10.4	41.69
	10	11.62	4.01	9.2	48.50
	15	14.52	4.66	8.8	55.53

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
219					
	1	5.28	1.96	6.7	18.39
	2	6.74	2.01	8.7	24.25
	3	7.95	2.30	8.9	28.44
	5	9.51	2.56	9.0	32.54
	7	10.59	3.04	9.5	39.51
	10	12.17	3.37	8.8	41.85
	15	14.52	3.26	8.8	43.17
158					
	1	5.16	2.85	7.0	25.10
	2	3.77	3.27	8.8	35.56
	3	7.92	3.63	8.9	40.25
	5	9.19	4.42	9.5	51.20
	7	10.35	4.88	9.6	57.22
	10	12.12	5.90	8.8	64.06
	15	15.34	7.70	8.4	80.28
185					
	1	5.14	2.30	7.1	21.48
	2	6.57	2.71	9.0	30.94
	3	7.76	3.05	9.2	35.80
	5	9.23	3.62	9.4	43.26
	7	10.62	3.90	9.4	47.30
	10	11.91	4.33	8.9	50.47
	15	14.60	4.99	8.8	58.55
191					
	1	5.50	1.98	6.3	17.96
	2	7.19	2.57	8.1	27.97
	3	8.09	2.76	8.8	32.37
	5	9.36	3.23	9.2	39.05
	7	10.58	3.65	9.3	44.55
	10	11.82	3.35	9.0	41.94
	15	14.80	4.20	8.7	51.31
151					
	1	4.38	0.90	8.2	11.77
	2	6.66	2.11	9.0	25.66
	3	8.00	2.52	8.9	30.40
	5	9.55	3.02	9.1	37.00
	7	11.07	3.36	9.1	41.63
	10	12.41	3.53	8.6	42.78
	15	15.24	3.44	8.5	44.51

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
8					
	1	5.10	1.90	7.0	18.37
	2	6.54	2.12	9.0	25.60
	3	8.07	2.60	8.9	31.19
	5	9.53	3.56	9.1	41.91
	7	10.79	3.73	9.2	45.08
	10	12.32	3.98	8.7	46.92
	15	15.15	4.75	8.5	55.52
24					
	1	4.94	1.44	7.3	15.46
	2	7.04	2.17	8.3	25.05
	3	8.14	2.74	8.8	32.30
	5	9.79	3.06	8.9	37.20
	7	10.76	3.37	9.2	41.80
	10	12.39	3.48	8.6	42.28
	15	14.71	4.07	8.8	50.56
33					
	1	6.09	2.72	5.6	21.32
	2	8.24	3.07	6.9	29.45
	3	9.63	2.85	7.1	29.85
	5	11.42	3.12	7.2	33.88
	7	13.16	3.84	7.3	41.17
	10	14.48	3.57	7.1	39.83
	15	18.47	4.81	6.8	51.16
40					
	1	5.22	1.64	6.8	16.34
	2	7.24	2.30	8.0	25.65
	3	8.71	3.20	8.0	34.34
	5	10.13	3.69	8.5	41.45
	7	11.50	3.96	8.5	45.15
	10	12.87	3.85	8.2	44.47
	15	15.44	4.91	8.4	56.72
16					
	1	5.37	2.08	6.8	19.54
	2	6.96	2.44	8.5	27.74
	3	8.09	3.01	8.8	34.61
	5	9.72	3.57	8.9	42.37
	7	10.64	3.57	9.3	43.84
	10	12.15	4.17	8.8	48.83
	15	14.84	5.30	8.7	60.94

Table 24 (contd.)

Stn. No.	Day	Adjusted Mean (inch)	Adjusted S.D. (inch)	Value of K_M	PMP (inch)
23					
	1	4.92	1.88	7.3	18.67
	2	6.79	2.39	8.7	27.56
	3	7.96	2.53	9.3	31.53
	5	9.48	2.87	9.0	35.32
	7	10.30	3.19	9.6	40.90
	10	11.51	3.08	9.2	39.86
	15	14.45	3.75	8.9	47.83
184					
	1	5.08	2.10	7.4	20.61
	2	6.60	2.89	9.0	32.62
	3	7.80	2.92	9.1	34.37
	5	9.09	3.47	9.5	42.01
	7	9.99	3.68	9.9	46.41
	10	11.64	3.68	9.2	45.53
	15	14.16	3.57	9.2	47.04
38					
	1	4.5	1.46	8.1	16.30
	2	6.02	2.19	9.6	27.02
	3	7.08	2.29	9.9	29.71
	5	8.53	2.58	10.2	34.90
	7	9.49	2.67	10.4	37.28
	10	10.82	2.84	9.8	38.67
	15	13.64	3.06	9.3	42.05
4					
	1	4.27	1.01	8.7	13.03
	2	6.09	1.64	9.4	21.47
	3	7.56	1.88	9.4	25.21
	5	9.43	3.42	9.1	40.67
	7	10.67	3.78	9.2	45.40
	10	11.74	4.09	9.1	48.95
	15	13.91	4.11	9.2	51.68
25					
	1	4.79	2.08	8.0	21.44
	2	6.43	2.85	9.1	32.41
	3	7.72	3.76	9.2	42.34
	5	9.23	4.14	9.4	48.10
	7	10.19	4.42	9.9	58.96
	10	11.14	4.37	9.6	53.12
	15	13.14	5.01	9.7	61.72

Table 25 : Distribution of Independent K_M .

Range of K	No. of Stations 1-Day	2-Day	3-Day	5-Day	7-Day	10-Day	15-Day
1.00-2.0	5	5	4	6	4	5	7
2.01-2.5	17	8	12	8	17	9	14
2.51-3.0	9	12	14	15	8	16	13
3.01-3.5	8	10	13	11	9	9	7
3.51-4.0	4	8	4	6	7	10	6
4.01-4.5	6	8	1	3	4	1	1
4.51-6.0	3	3	3	2	4	4	5
6.01-7.0	3	-	3	3	1	1	2
7.01-	-	1	1	1	1	-	-
Max. Value	6.49	7.50	7.86	7.02	7.32	6.29	6.7

Table 26 : Relationship between Length of Record and K_M for 100-year Return Period

Length of Record (yr.)	K_M
15	4.0
20	3.8
25	3.7
30	3.7
40	3.6
50	3.5

Source : Hershfield, D.M.

APPENDIX - B

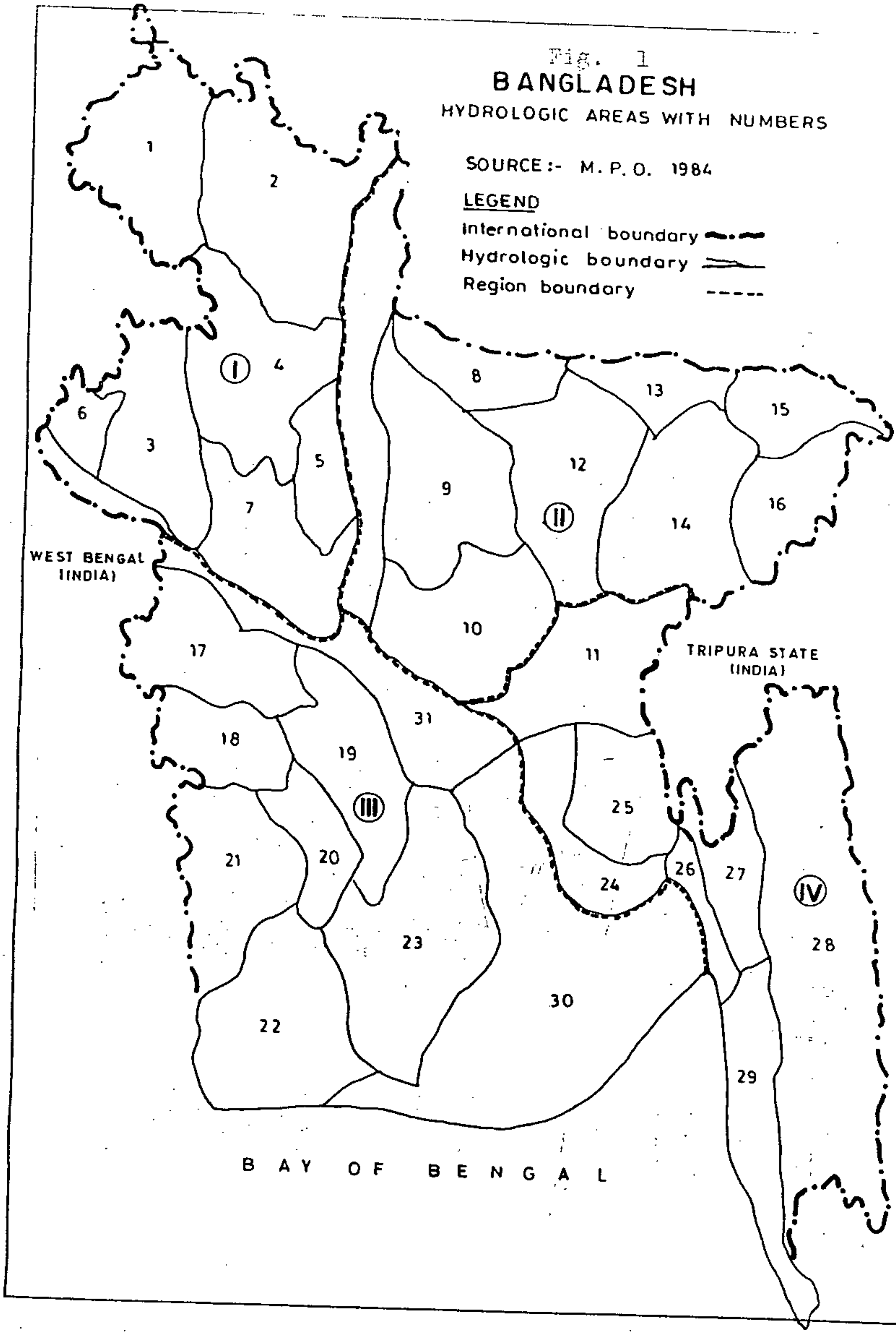


Fig. 1. Map showing the four hydrological regions and the hydrological areas with area number proposed by the MPO.

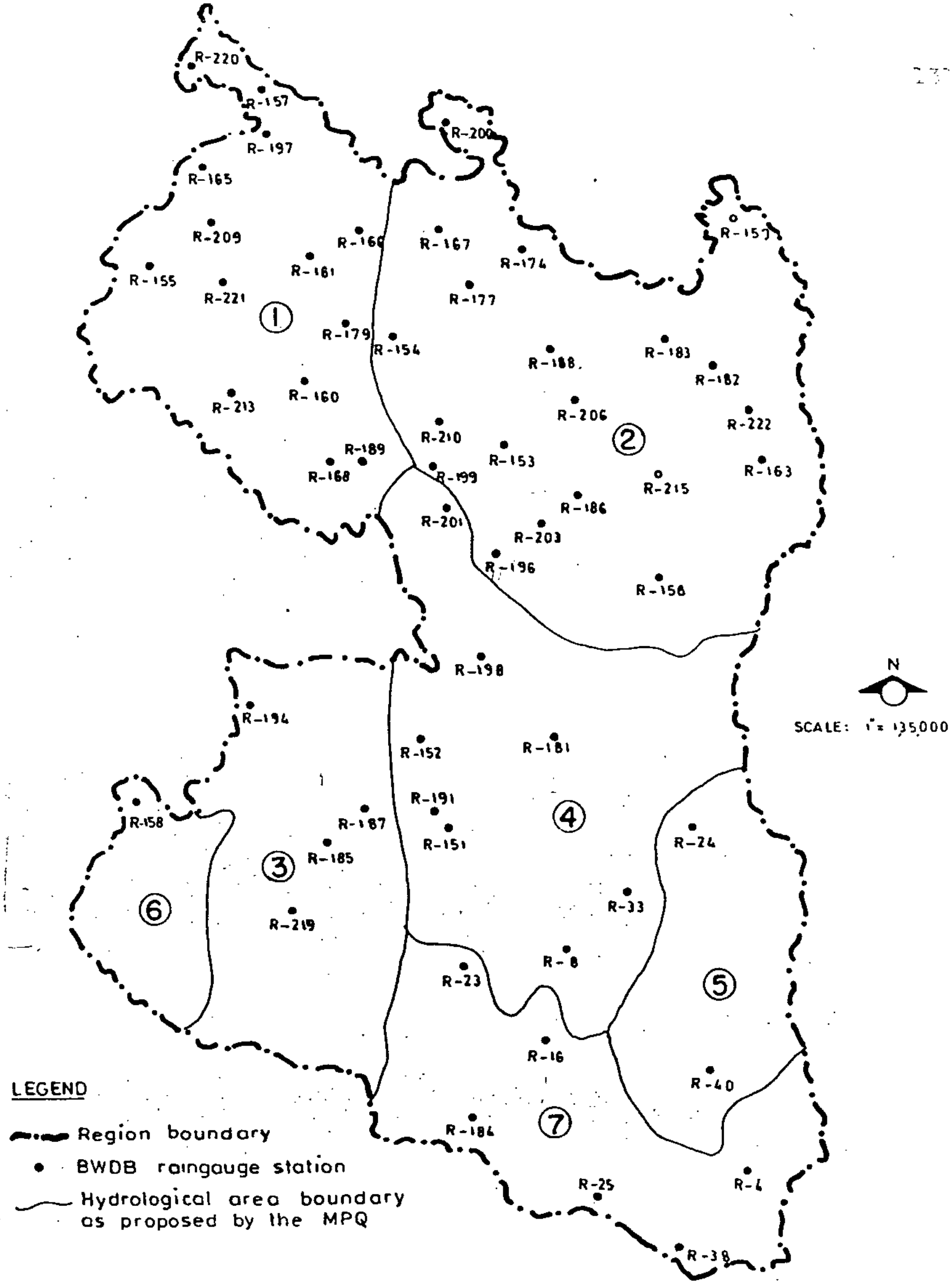
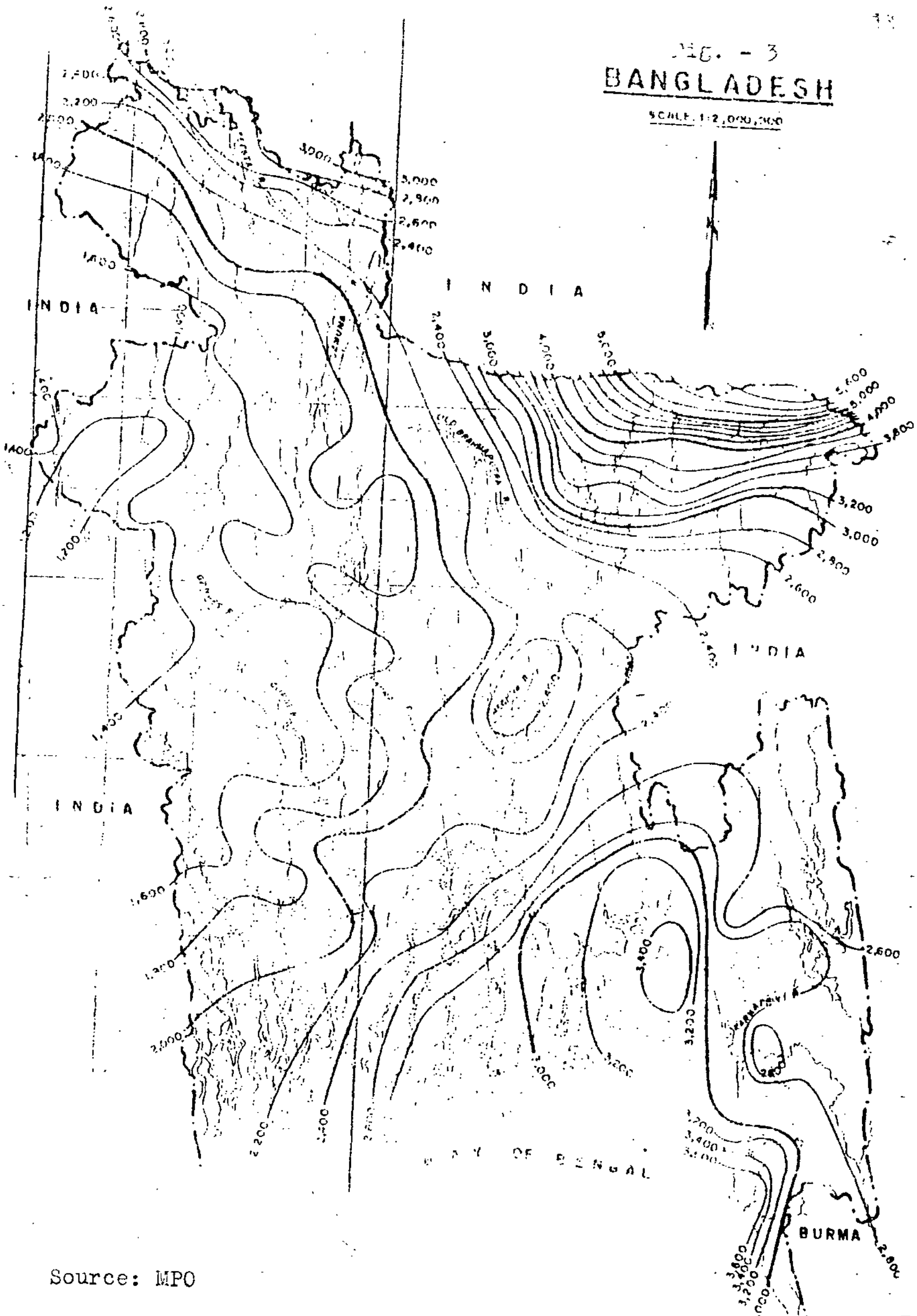


Fig. 2. Map showing the location of the selected rainfall stations of the north-west region.

FIG. - 3
BANGLADESH
SCALE 1:2,000,000



Source: MPO

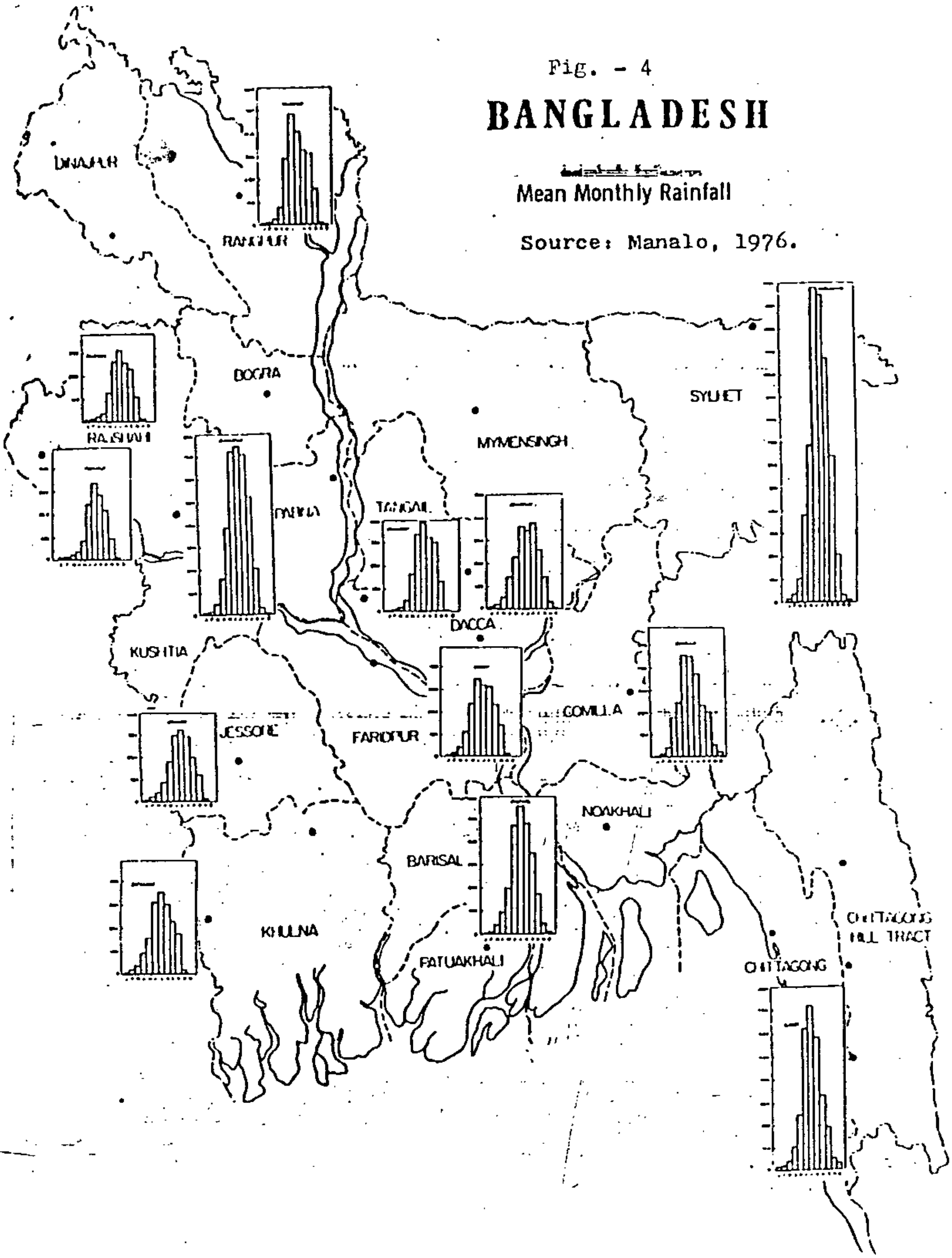


Fig. 4. Mean monthly rainfall histogram of Bangladesh .

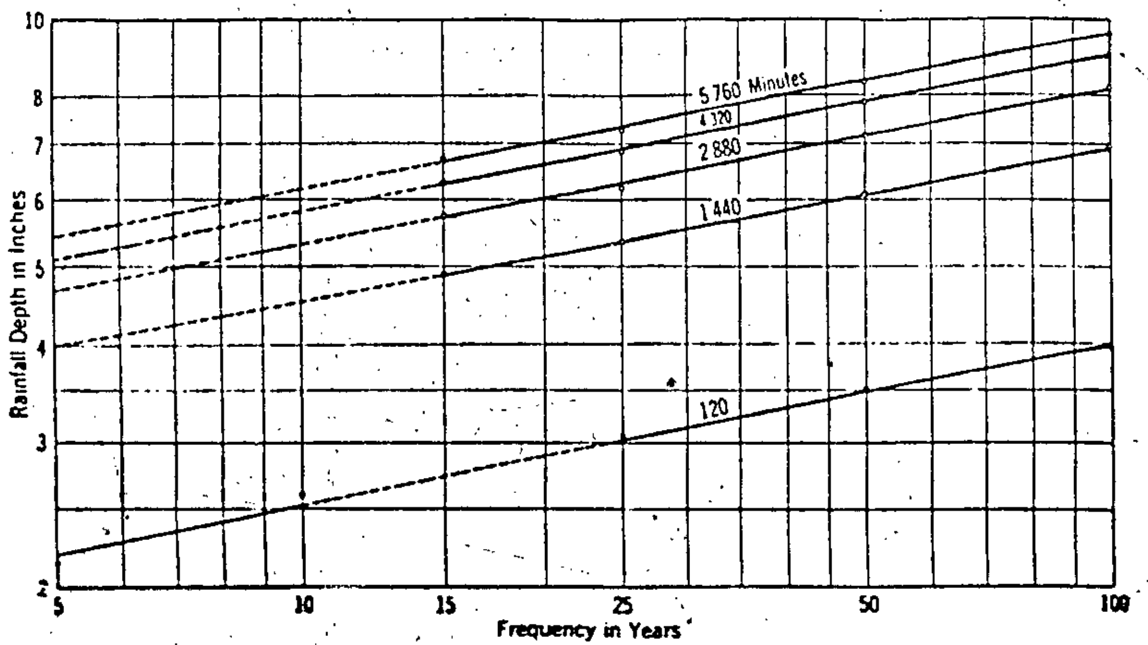


Fig. 5. Rainfall depth-duration-frequency curve for the eastern U.S. (After Bernerd)

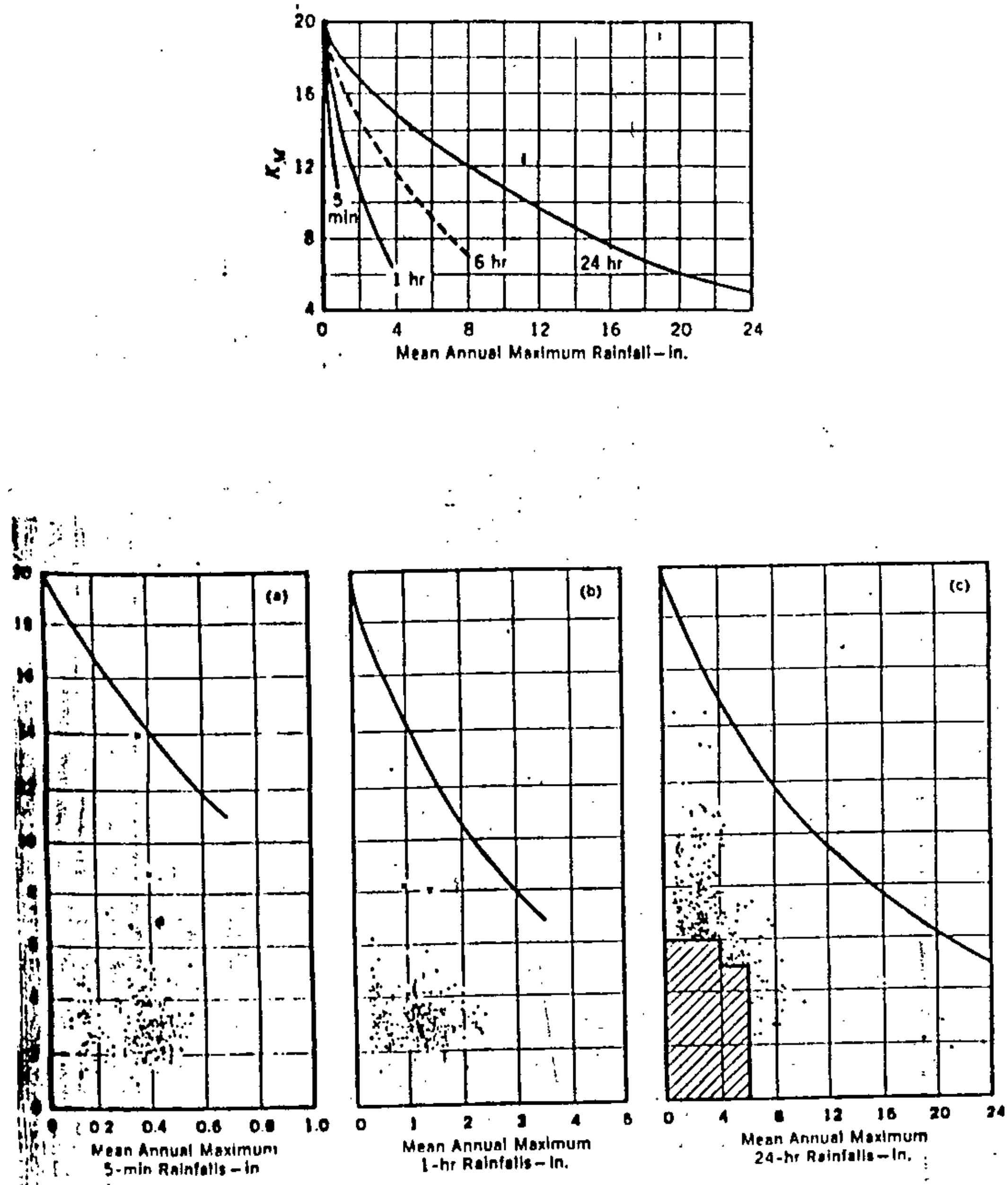


Fig. 6. K_M against Mean Annual Maximum Rainfall . (After Hershfield).

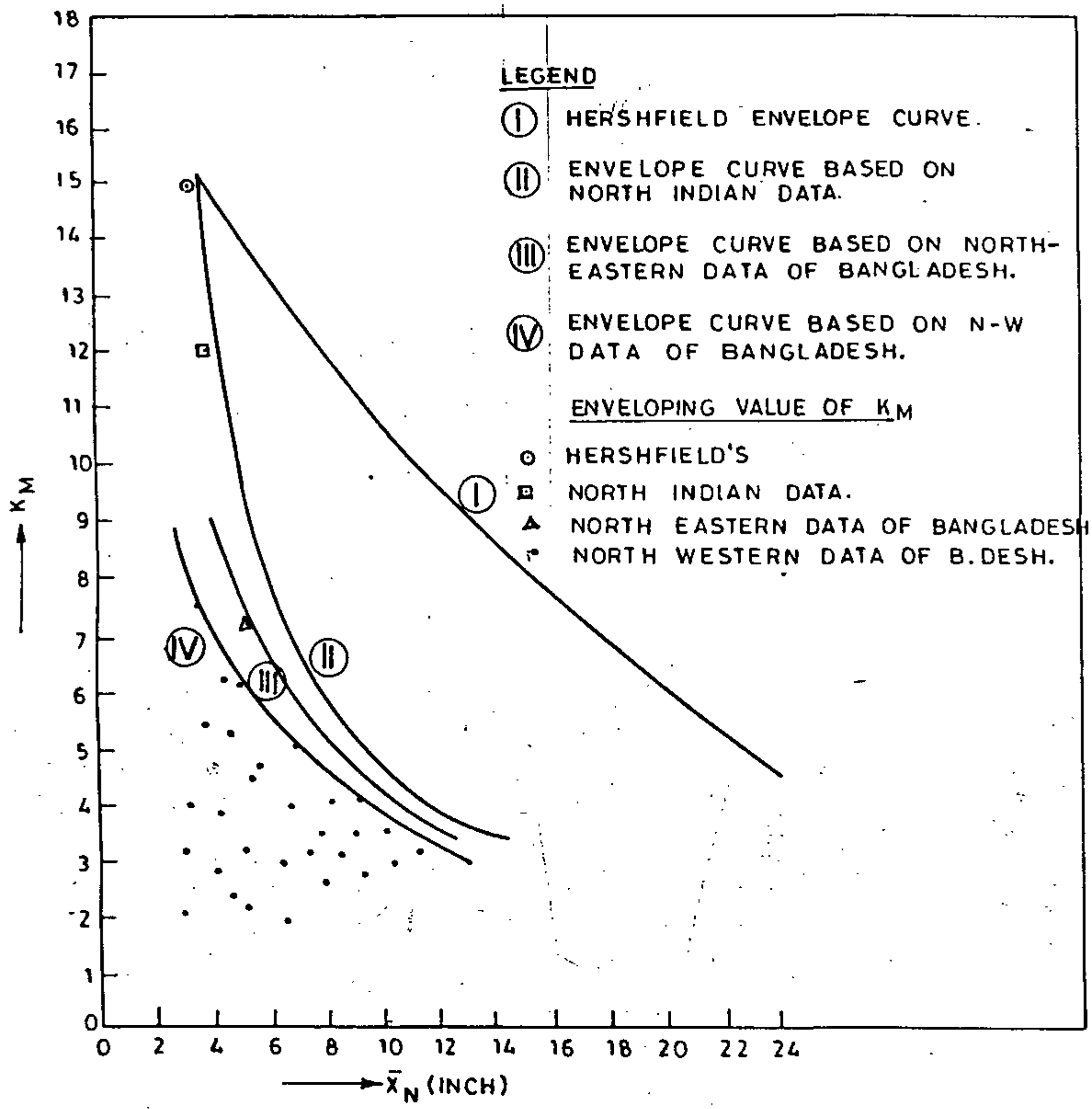
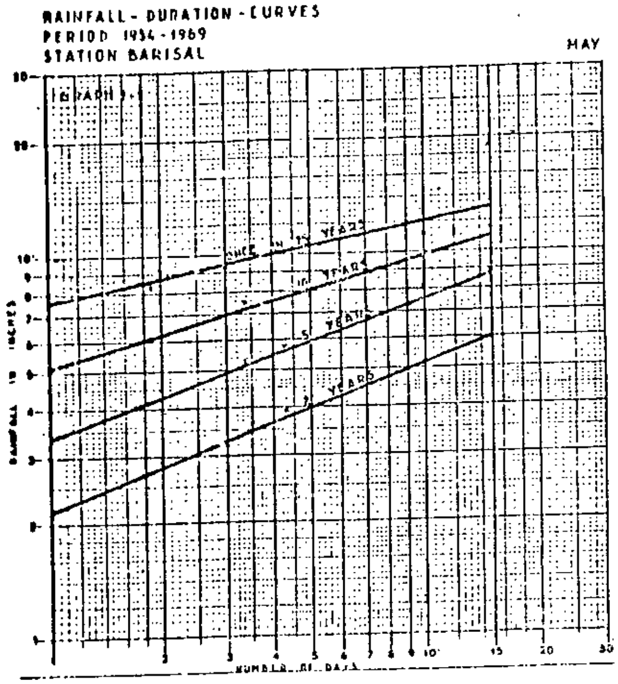


Fig. 7. K_M as a function of Mean Annual Maximum one-day rainfall .



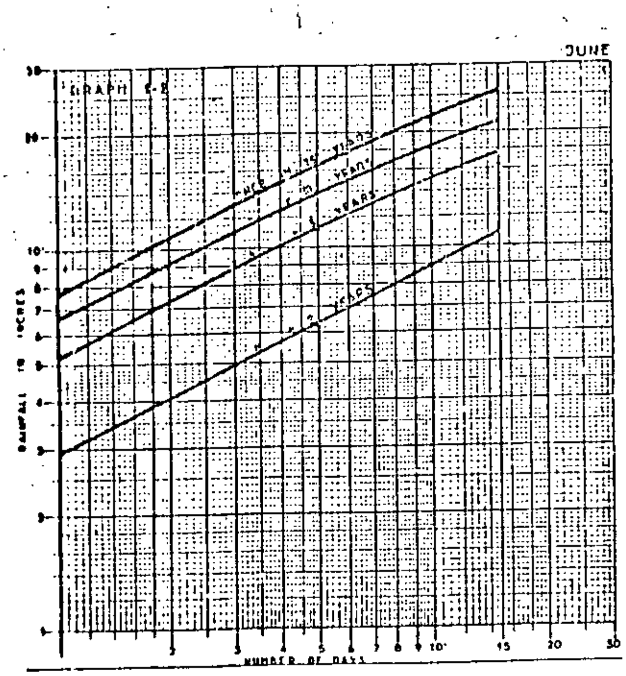


Fig. 8. Rainfall duration curve of Barisal (May-June).

PROBABILITY PROFILE OF REACHING OR EXCEEDING SPECIFIED RAINFALL AMOUNTS IN ANY WEEK

(Starting with the First Week of March as Week 1)

BARISAL

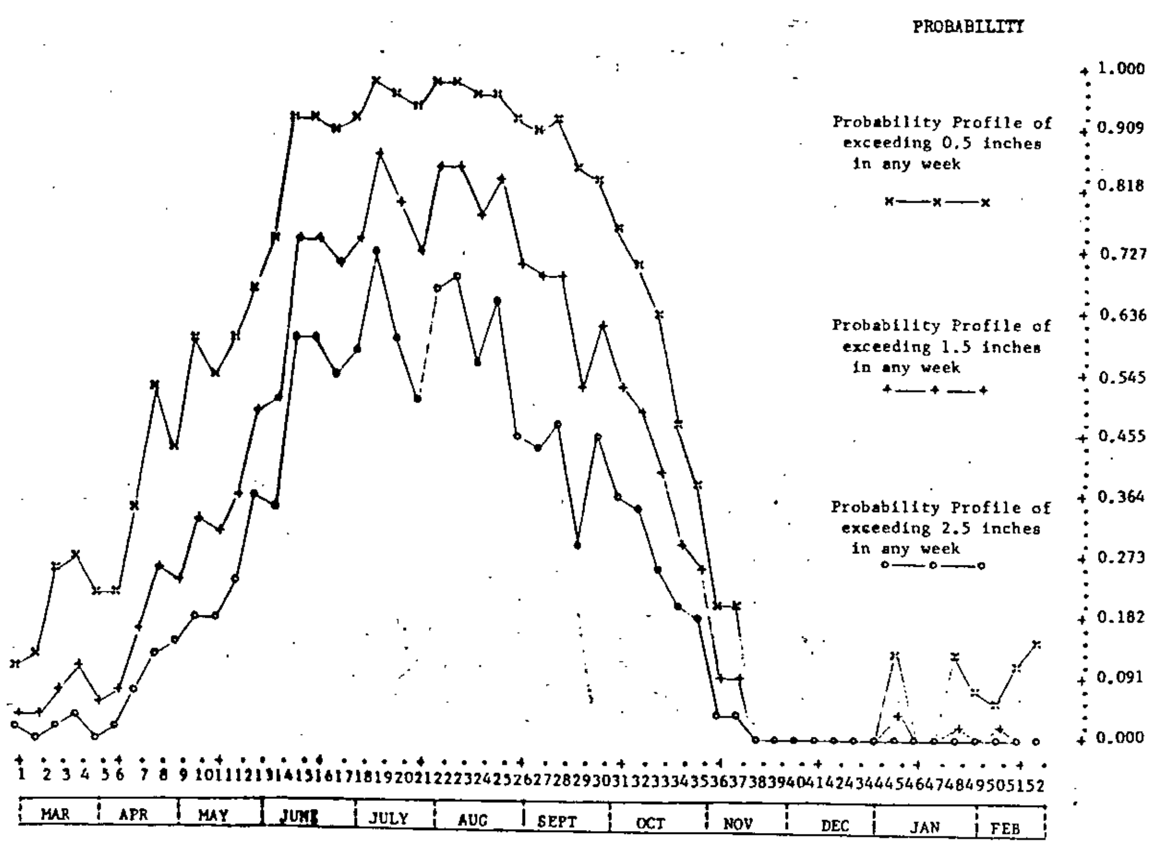
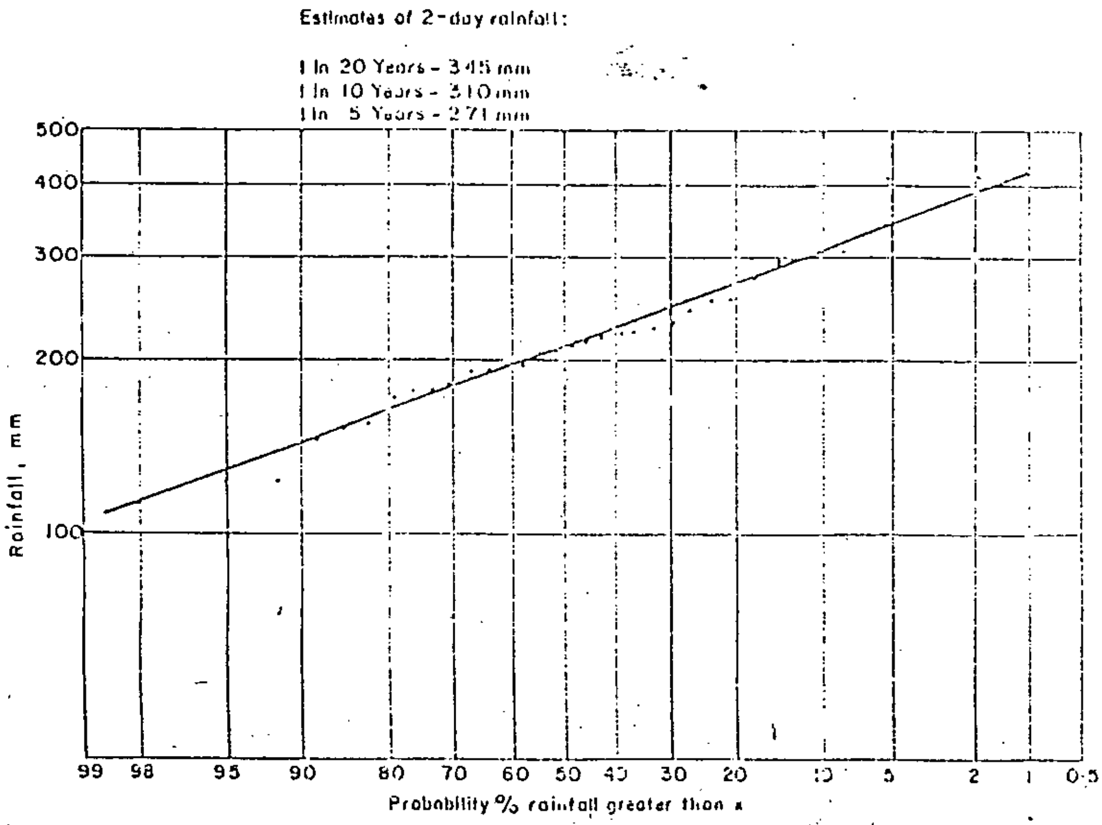


Fig. 9. Probability profile of reaching or exceeding Specific rainfall amounts in any week (Barisal).



Fig, 10. Probability of 2-day Annual Maximum rainfall of Rangpur (Source: Water Balance Studies Report)

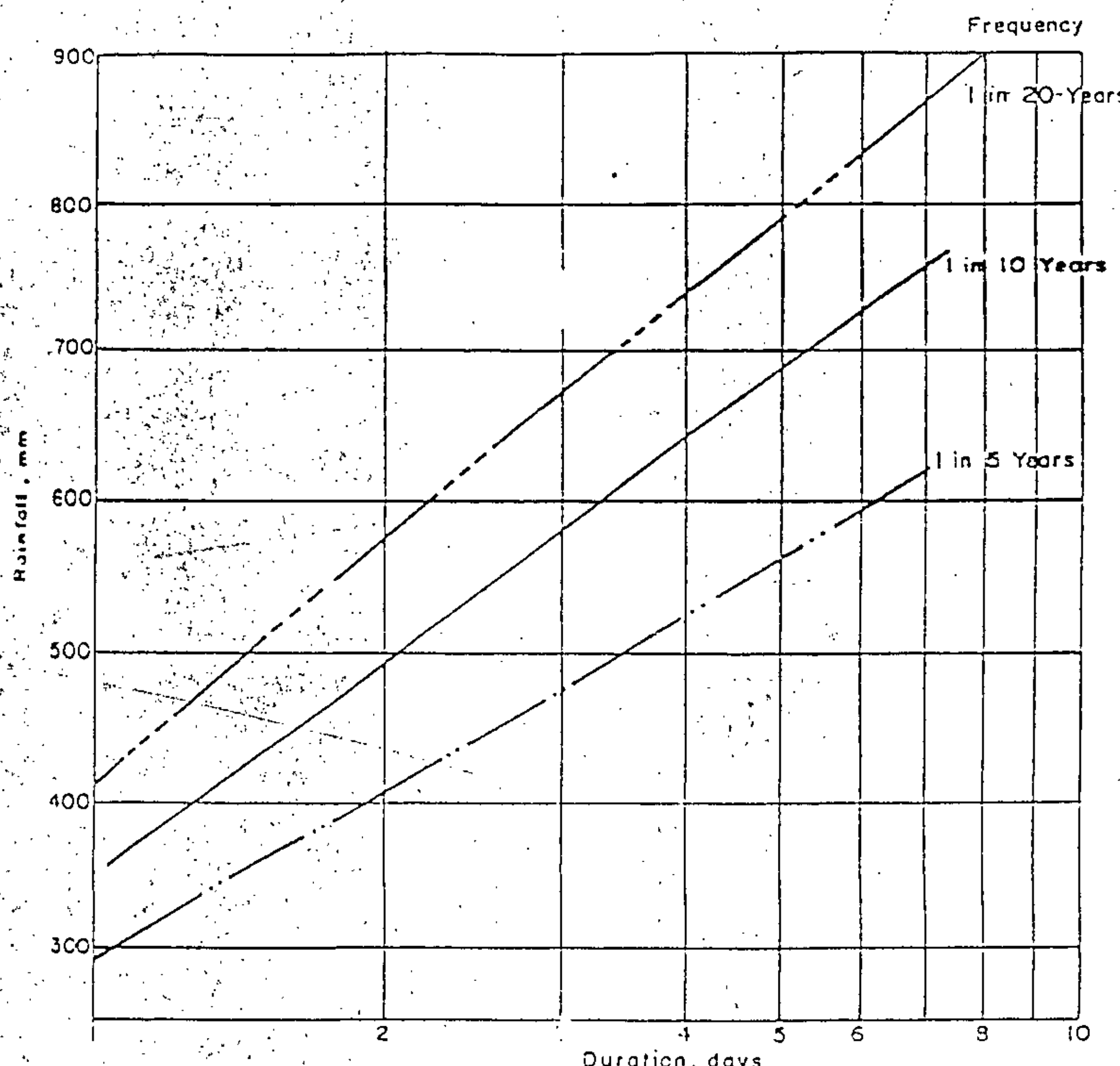


Fig.11. Depth-duration-frequency curve of Sylhet.
(Bangladesh Water Balance Studies Report)

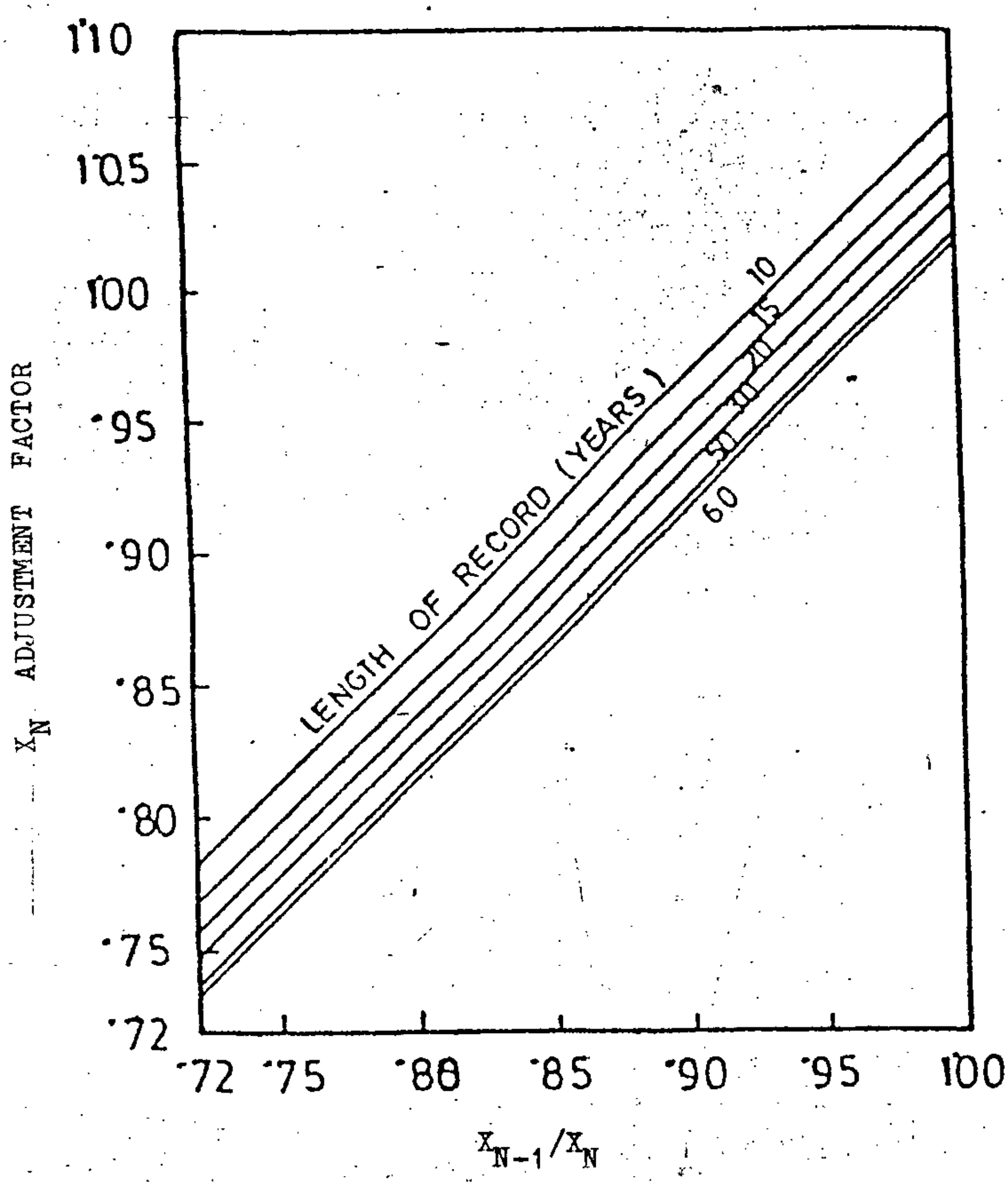


Fig. 12. Adjustment of Mean for Maximum observed rainfall (After Hershfield).

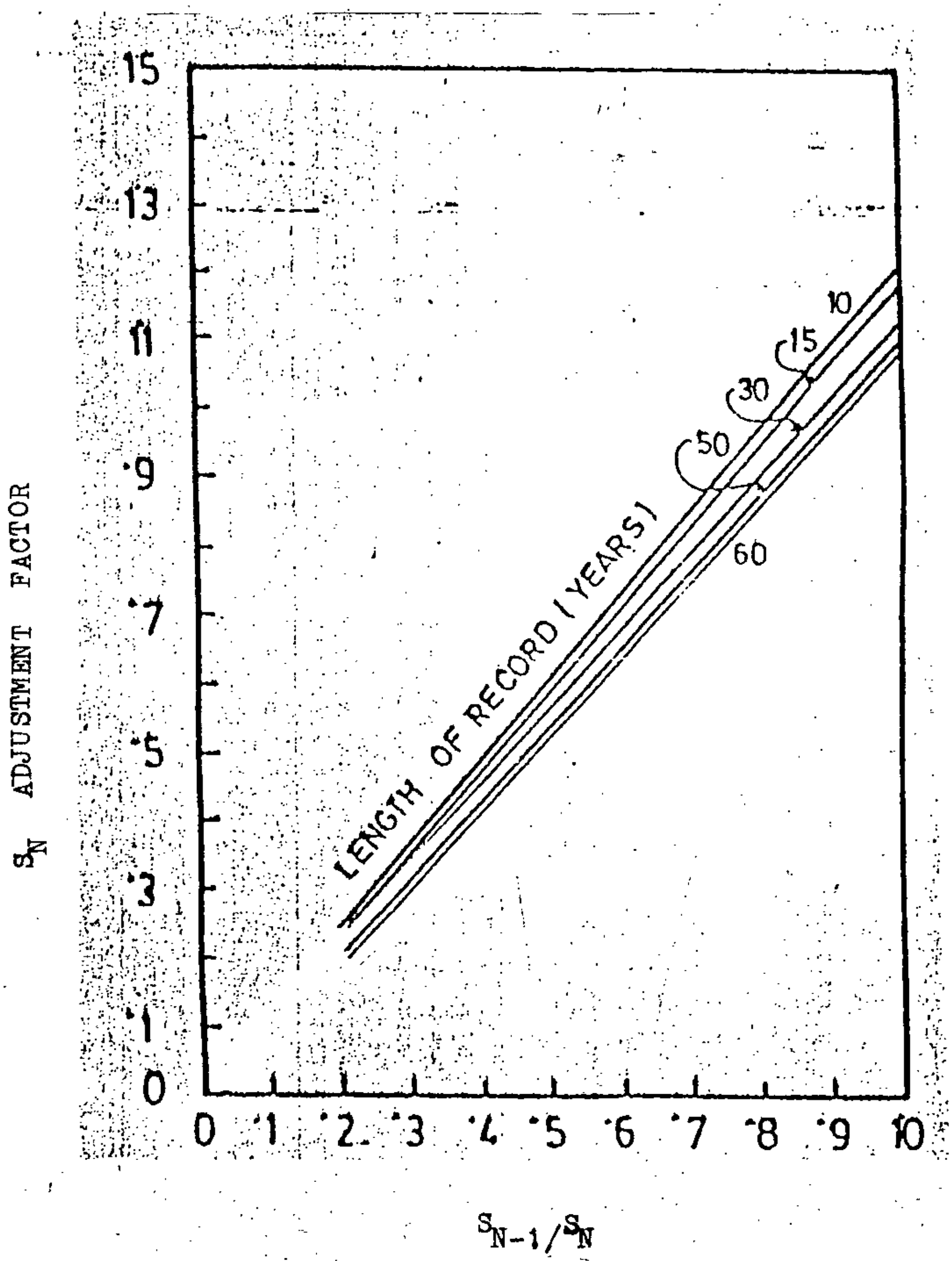


Fig. 13. Diagram for adjusting the Standard deviation for Maximum observed rainfall (After Hershfield)

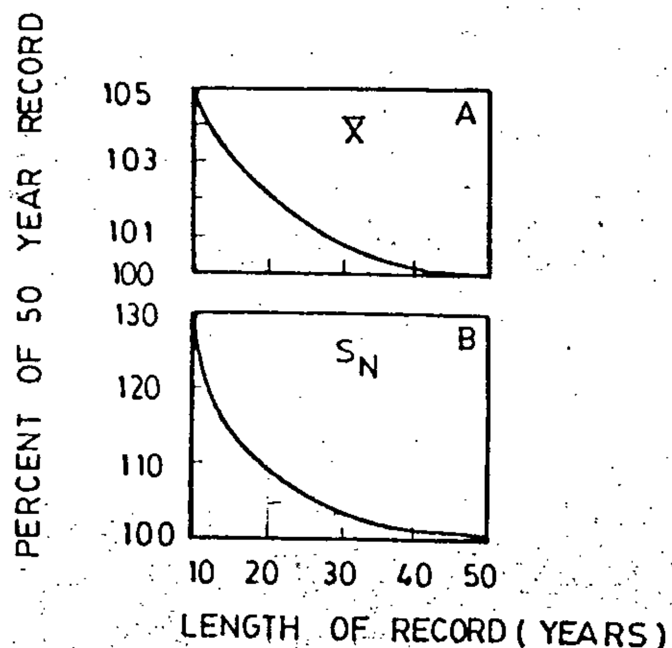


Fig. 14. Sample size adjustment diagram.

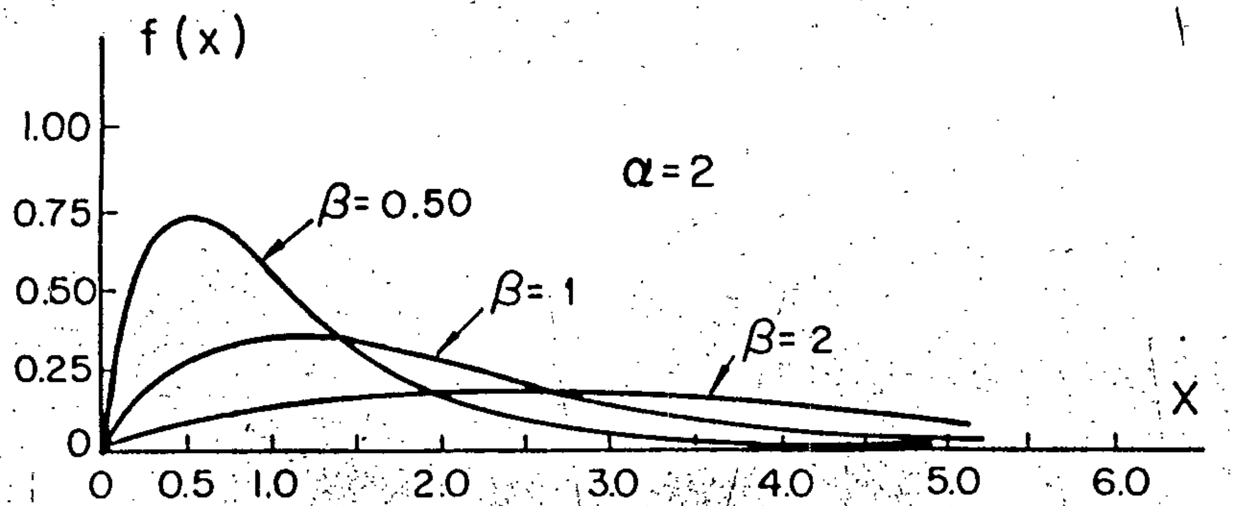


Fig.15. Two-parameter gamma probability density curves for
- 2 and three values of (0.05, 1, 2)

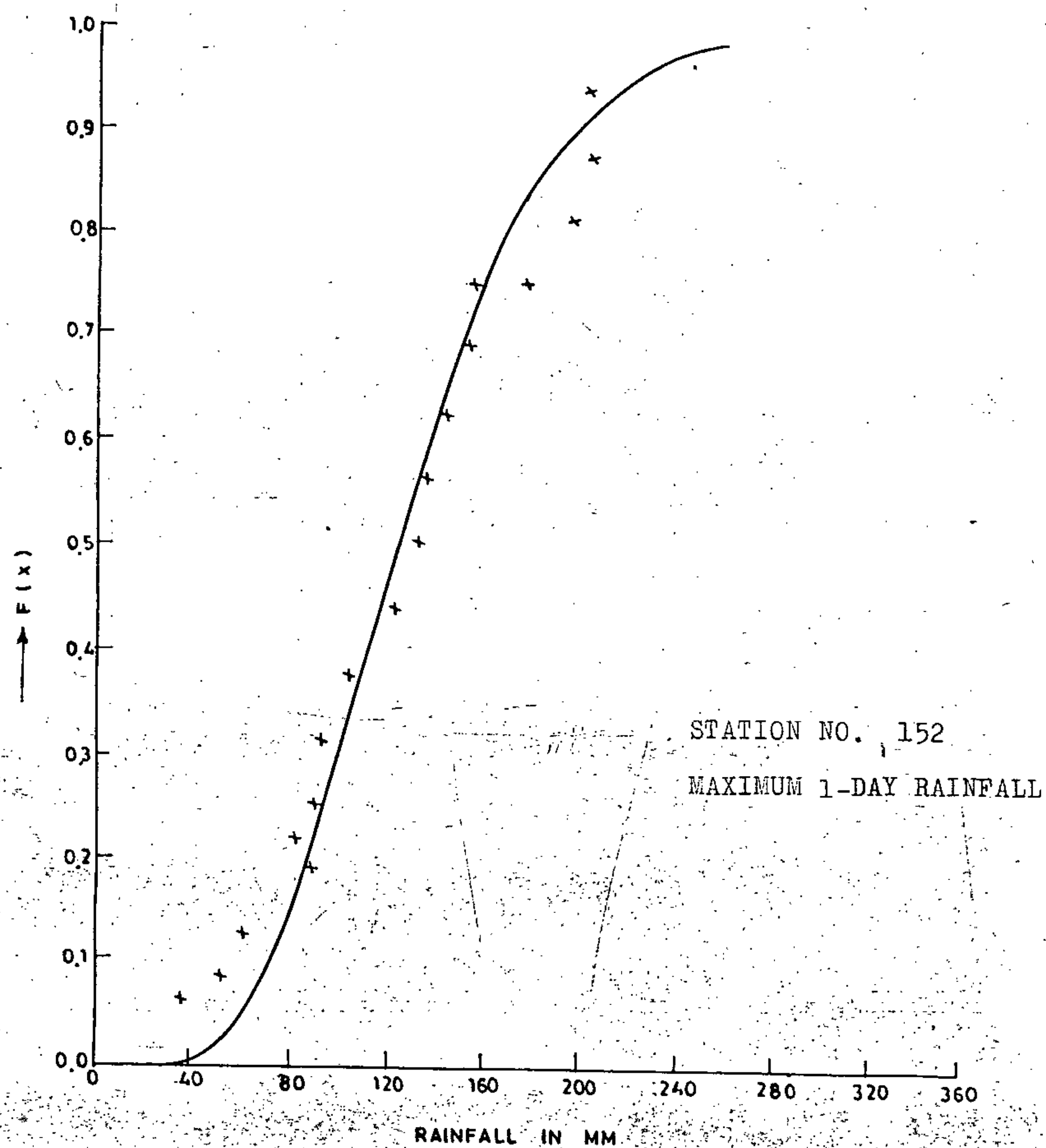


Fig. 16. Typical plotting of data on Gamma probability paper.

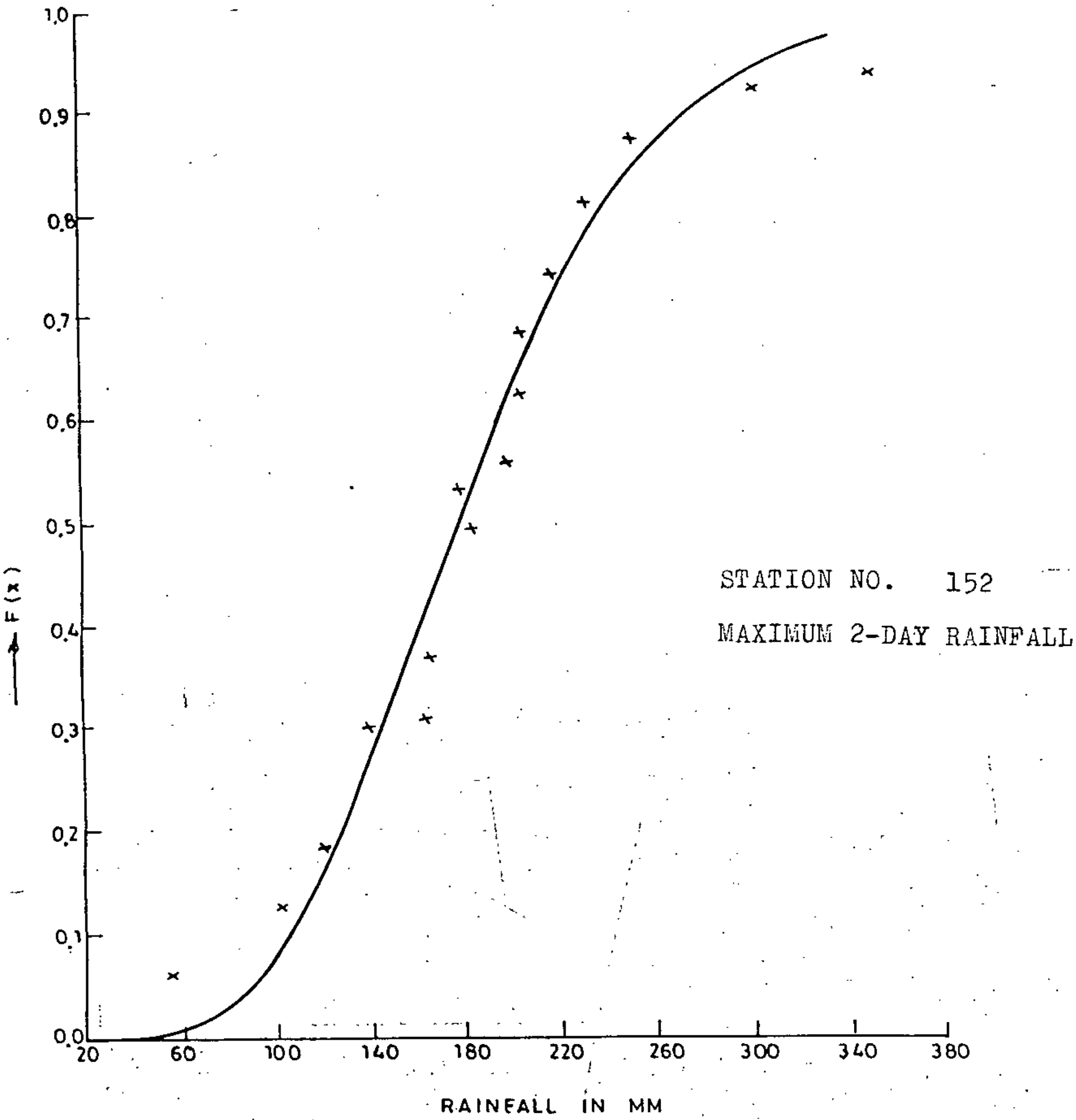


Fig. 17. Typical plotting of data on Gamma probability paper.

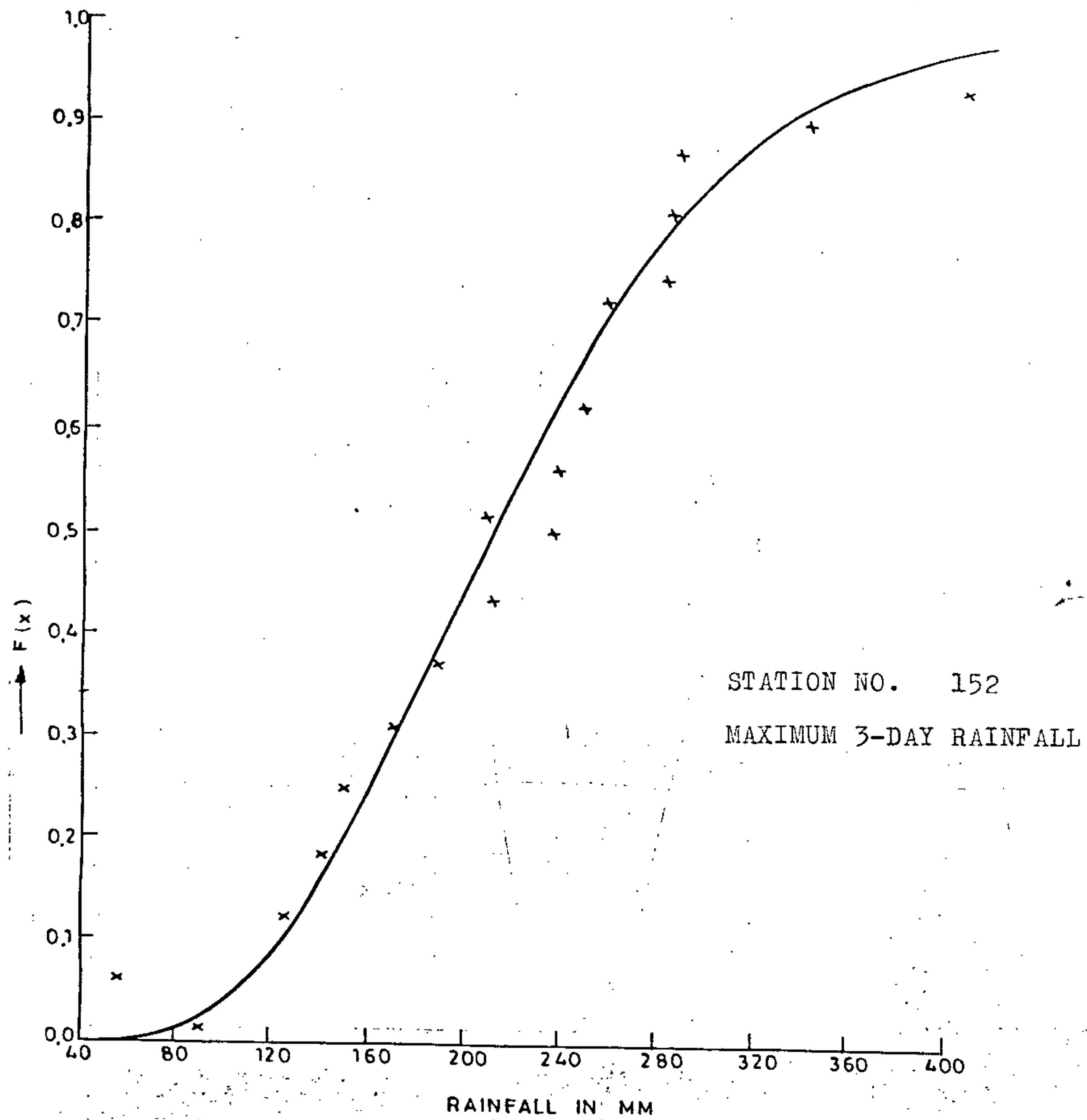


Fig. 18. Typical plotting on Gamma probability paper.

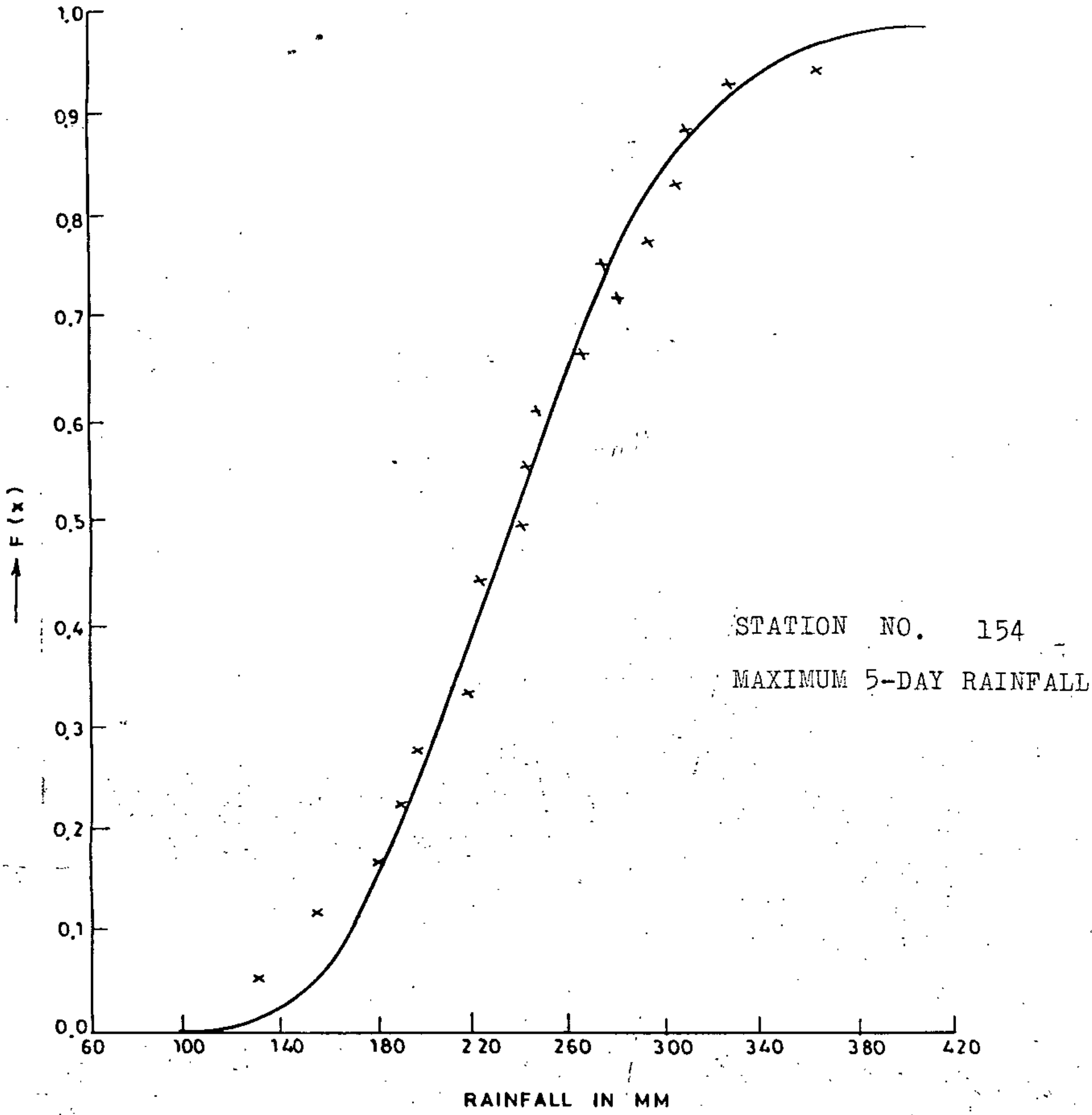


Fig. 19. Typical plotting of data on Gamma probability paper.

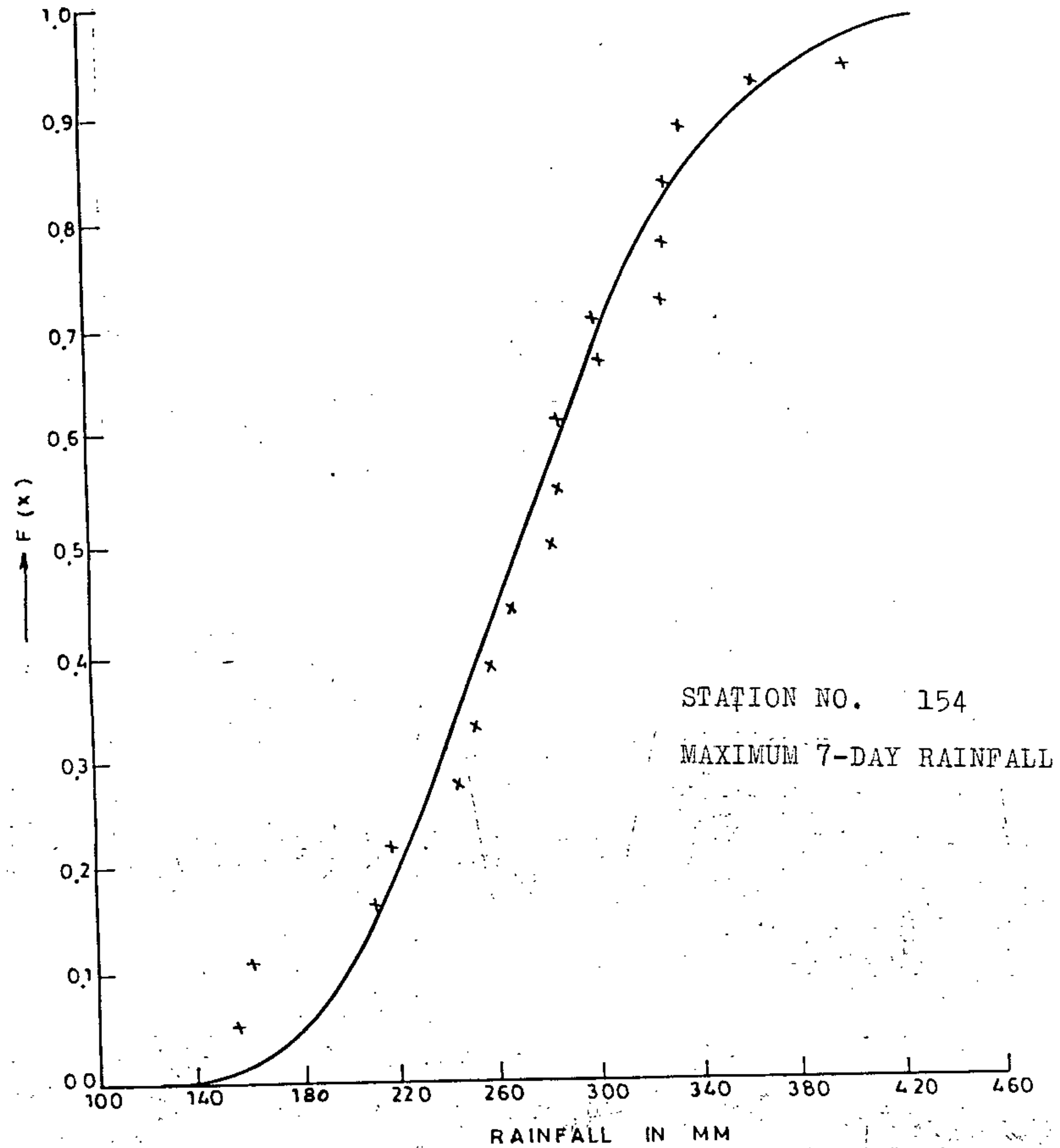


Fig. 20. Typical plotting on Gamma probability paper.

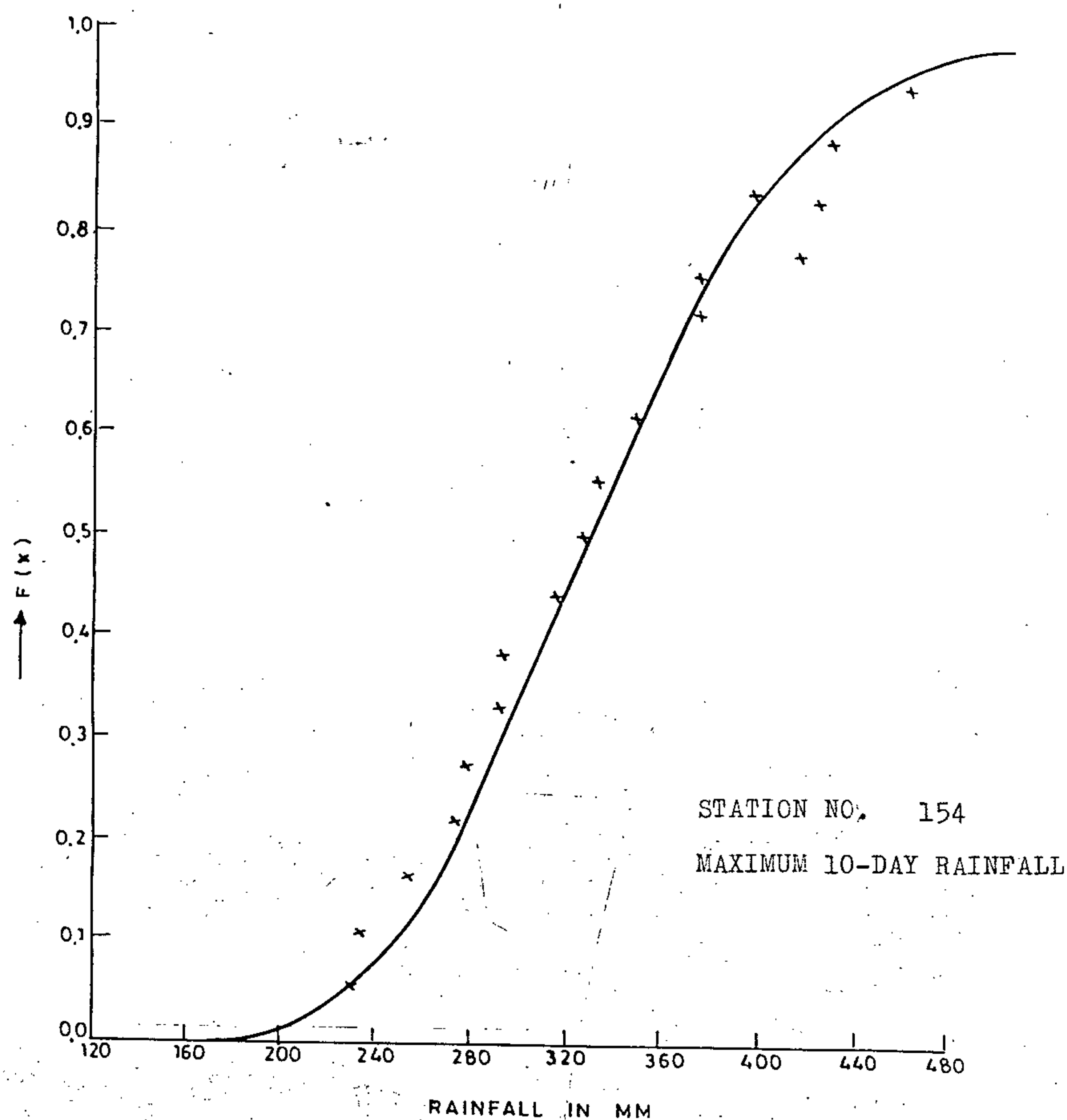


Fig. 21. Typical plotting of data on Gamma probability paper .

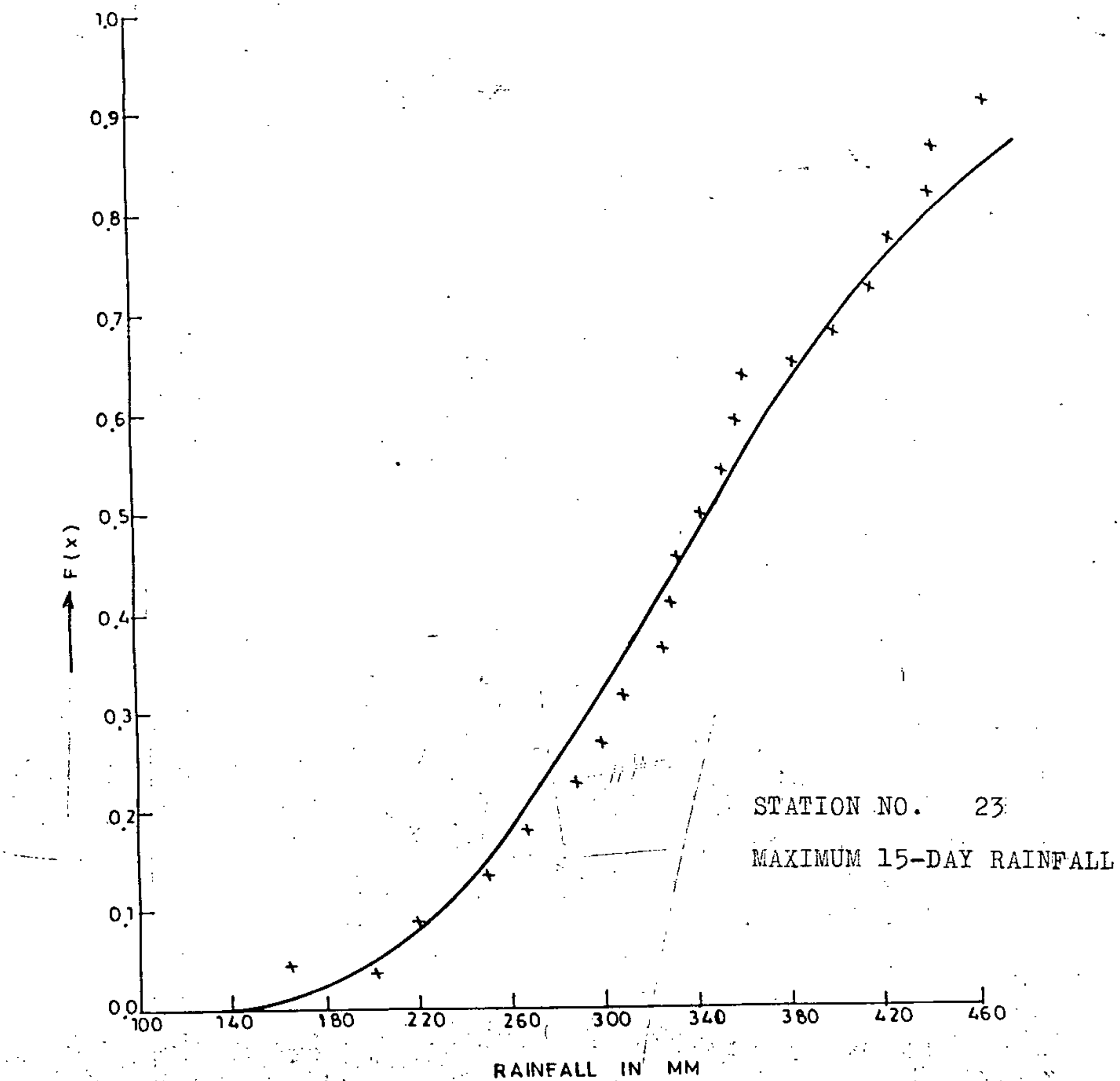


Fig. 22. Typical plotting of data on Gamma probability paper.

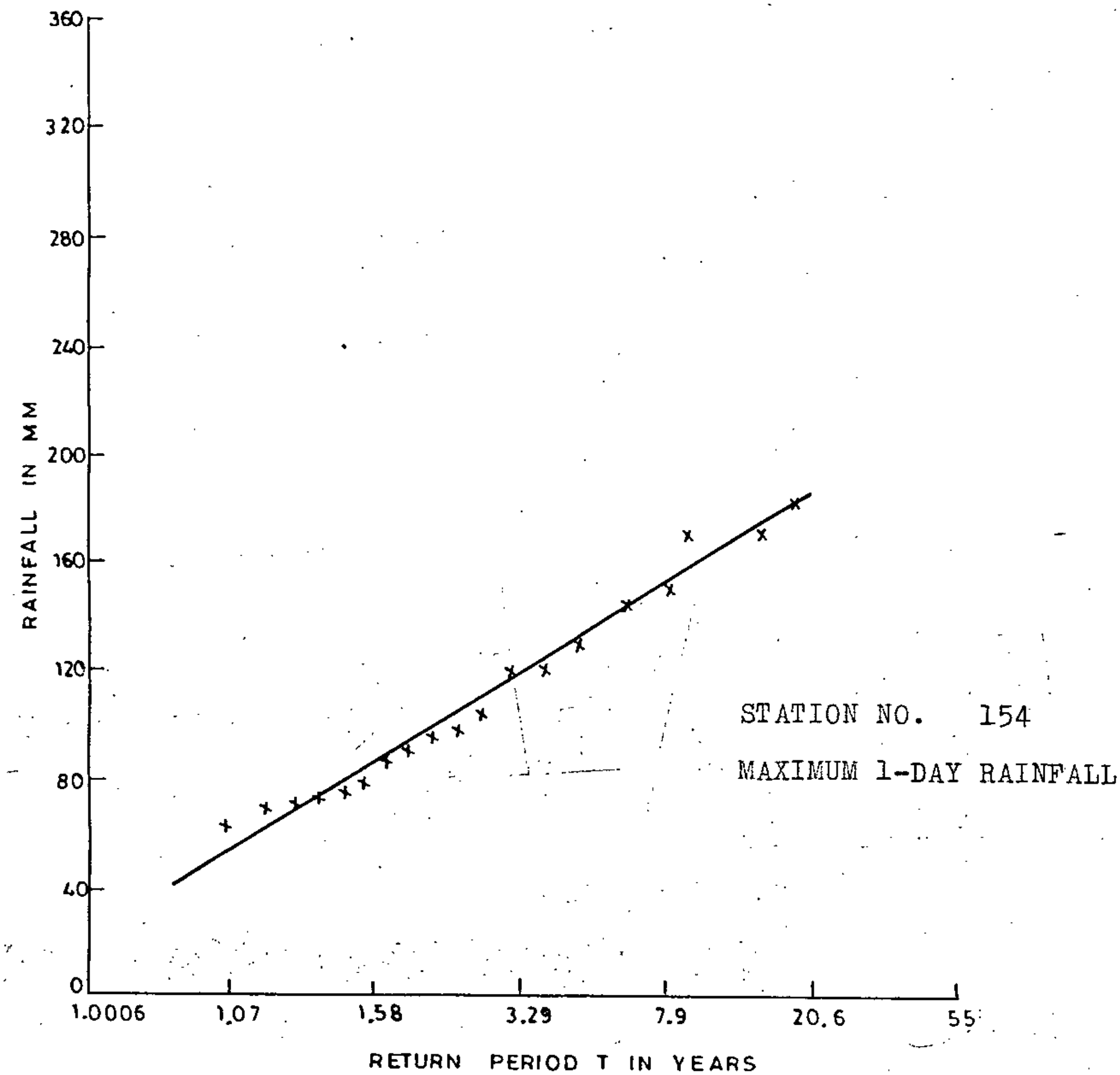


Fig. 23. Typical plotting of data on Gumbel probability paper.

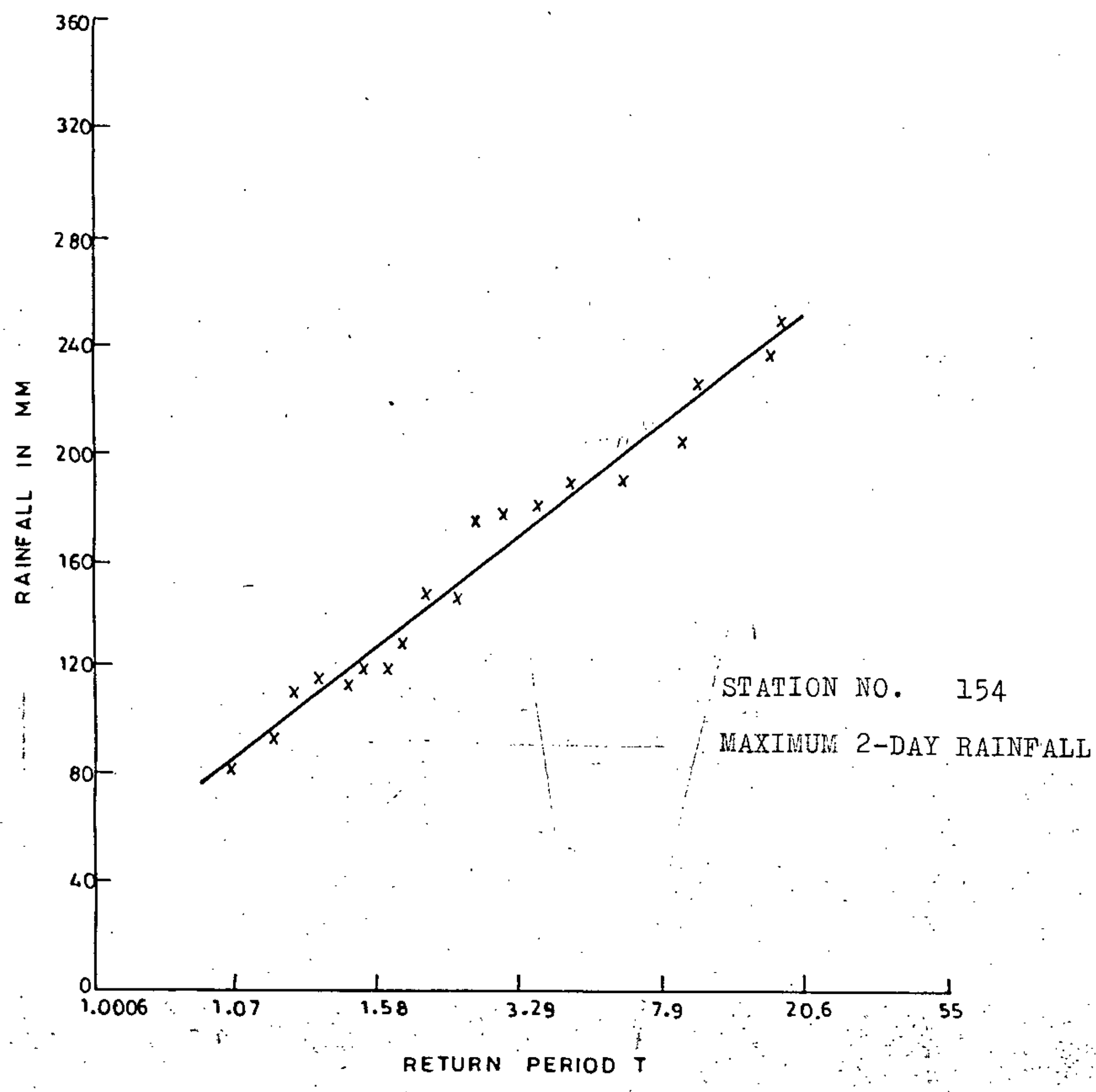


Fig. 24. Typical plotting of data on Gumbel probability paper.

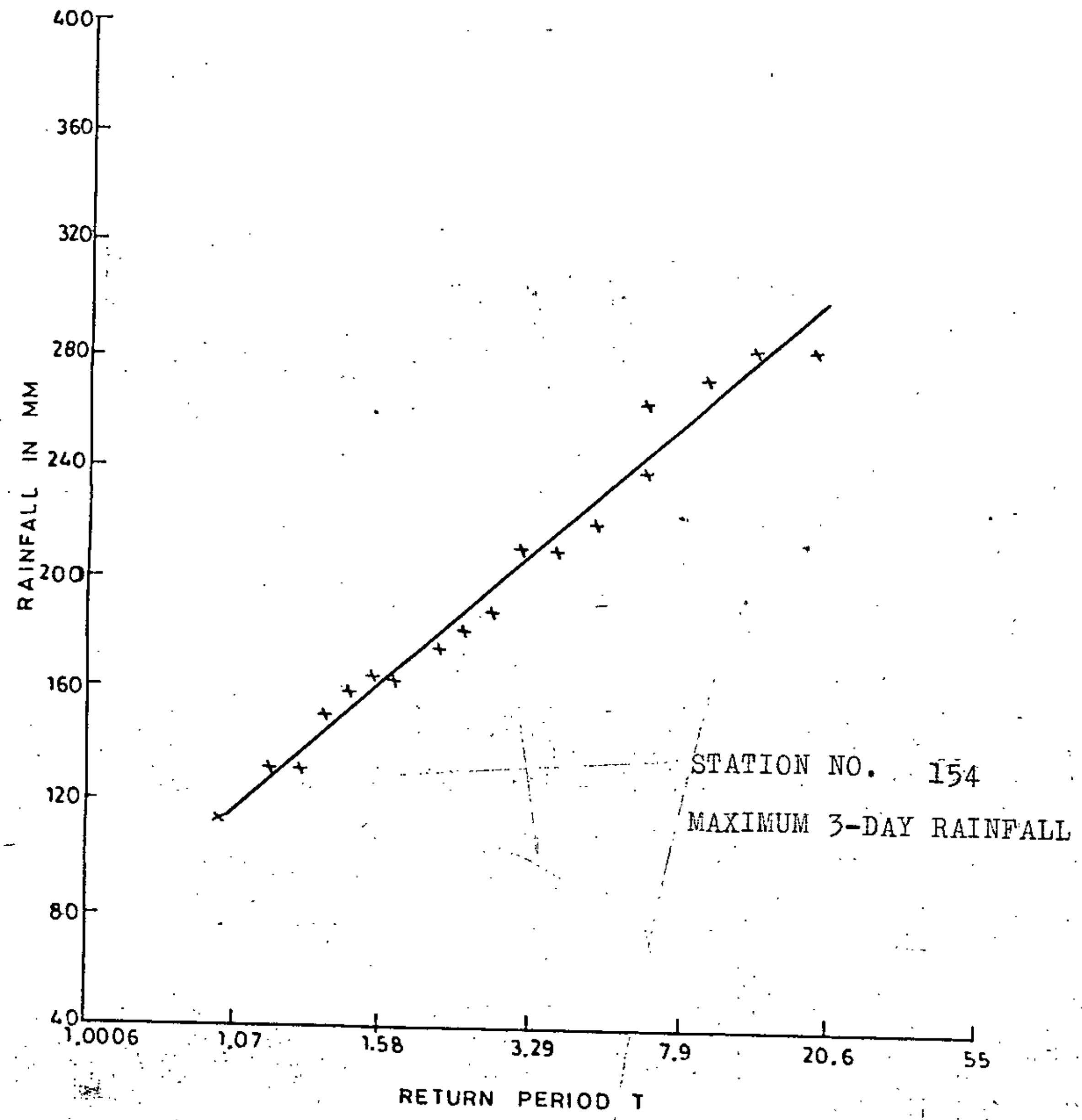


Fig. 25. Typical plotting of data on Gumbel probability paper.

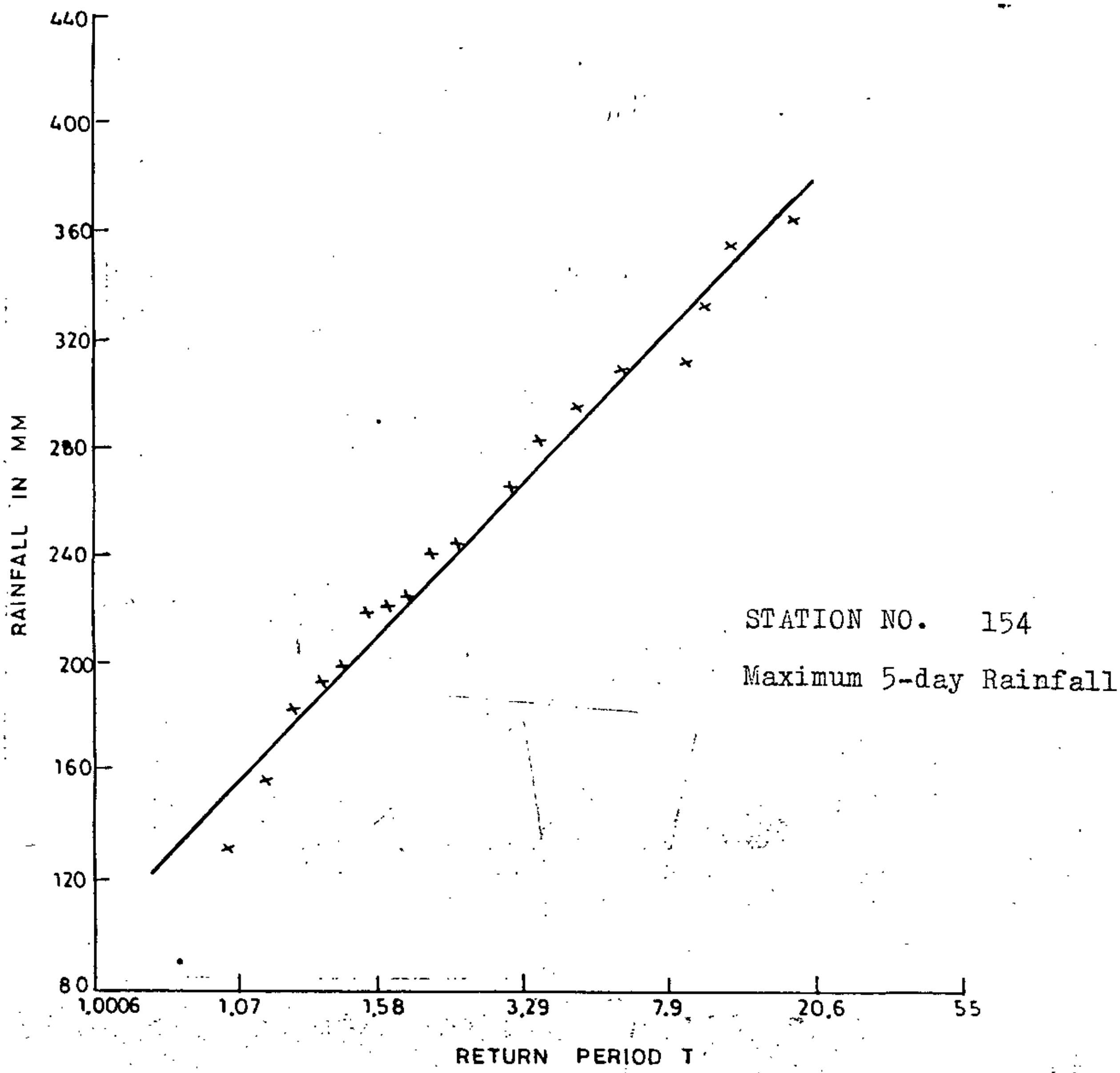


Fig. 26. Typical plottin of data on Gumbel probability paper.

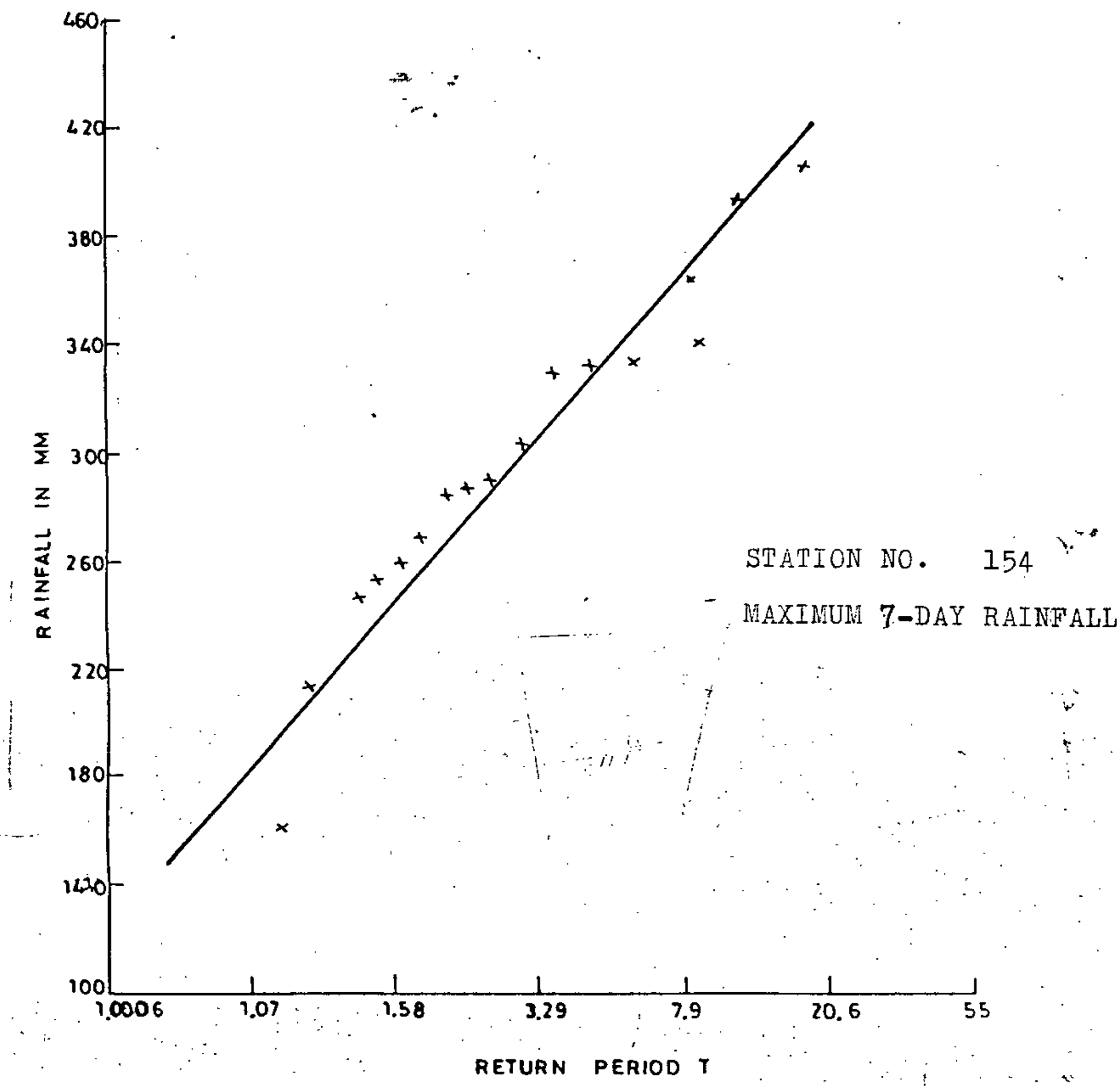


Fig. 27. Typical plotting of data on Gumbel probability paper.

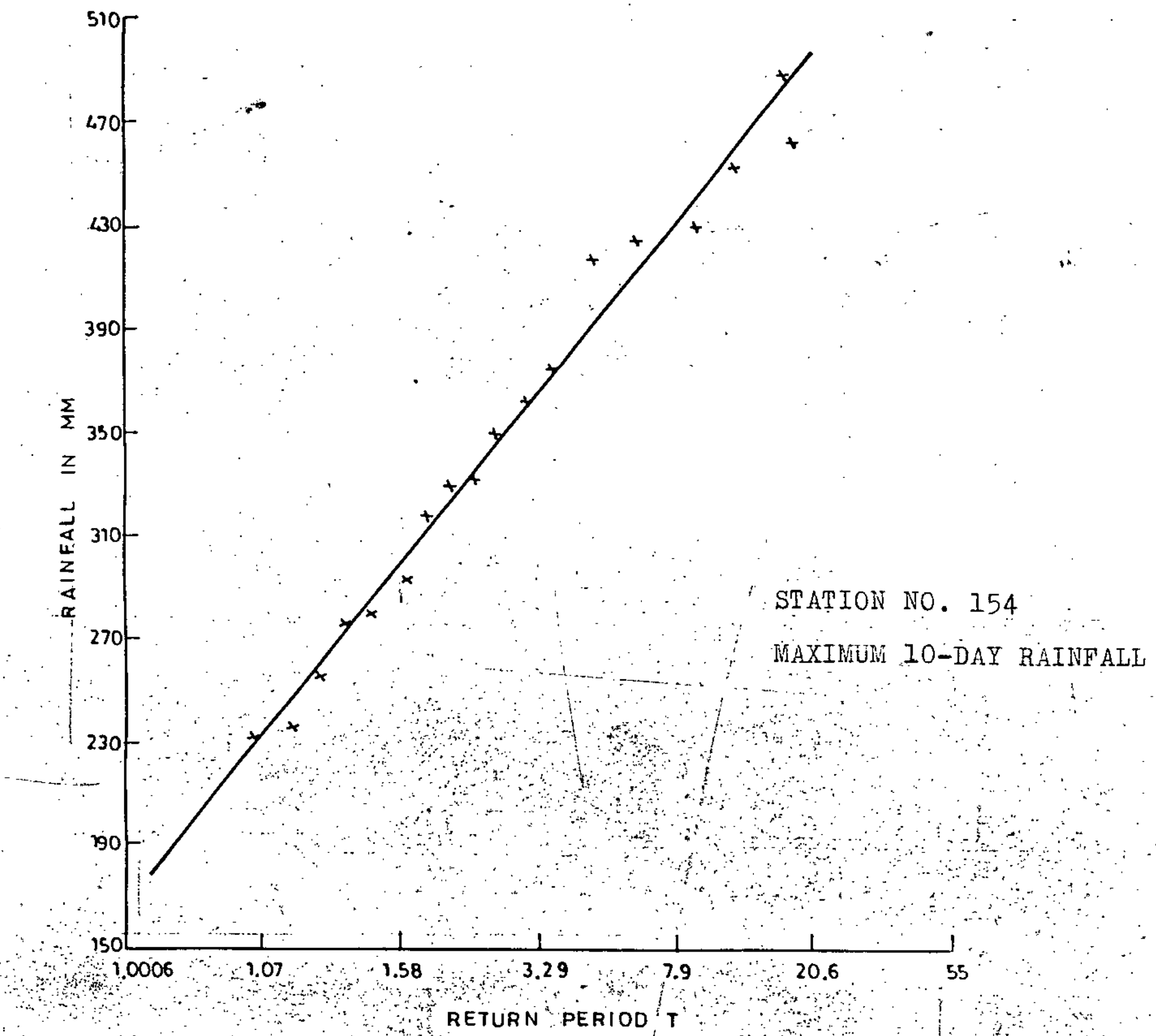


Fig. 28. Typical plotting of data on Gumbel probability paper.

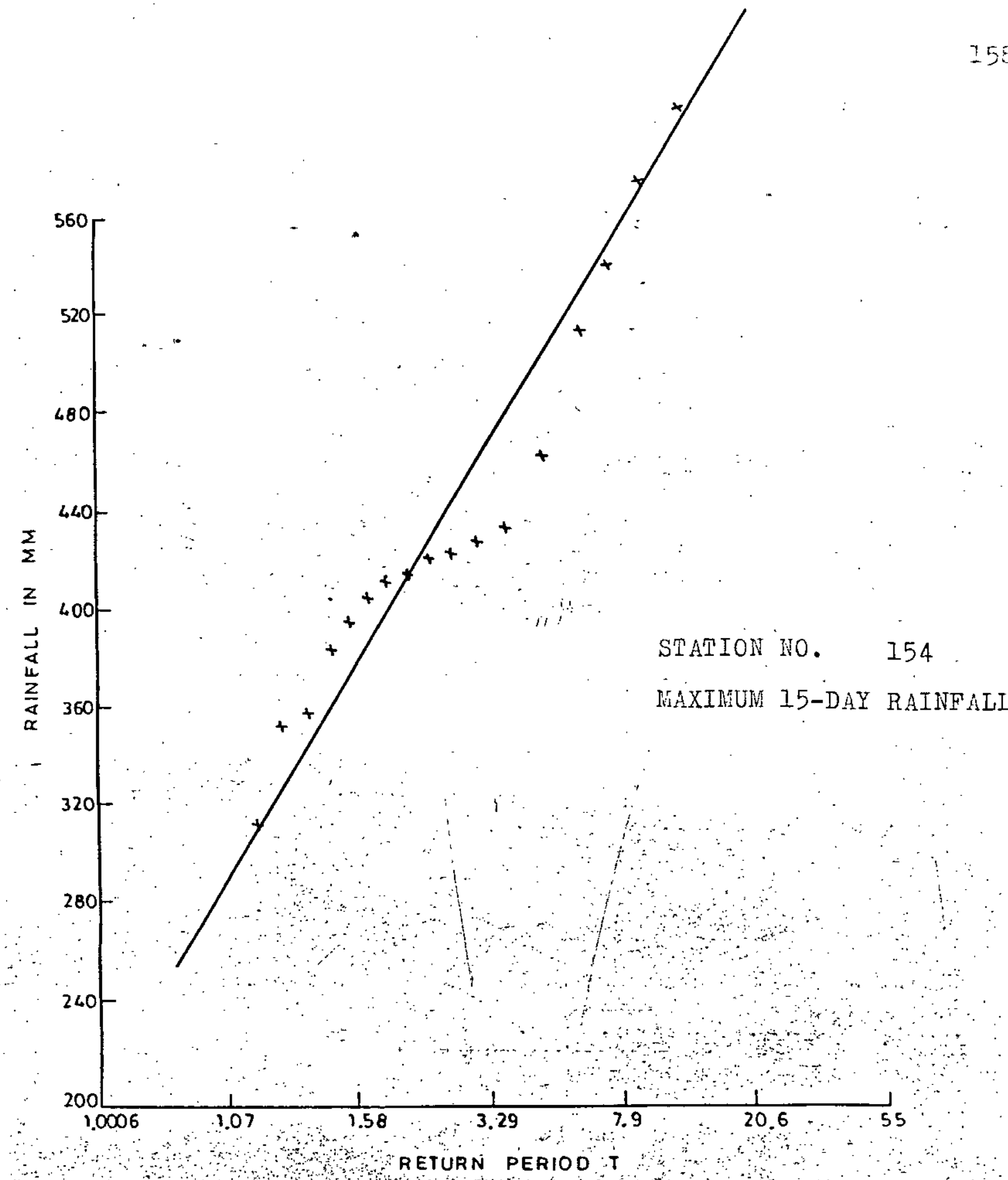


Fig. 29. Typical plotting of data on Gumbel probability paper.

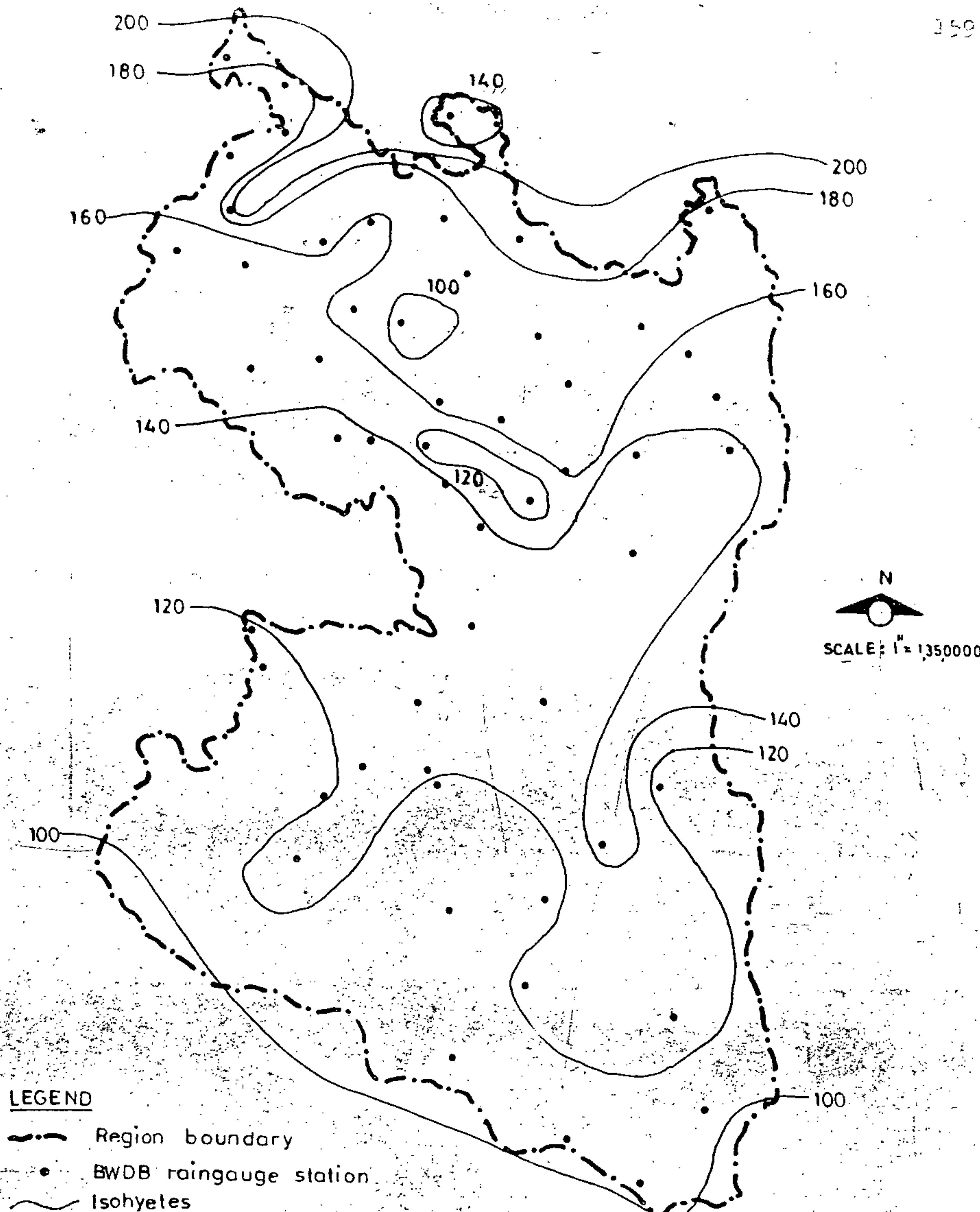


Fig. 30. Generalized isohyetal map of 1-day rainfall having 2 year Return Period (mm.).

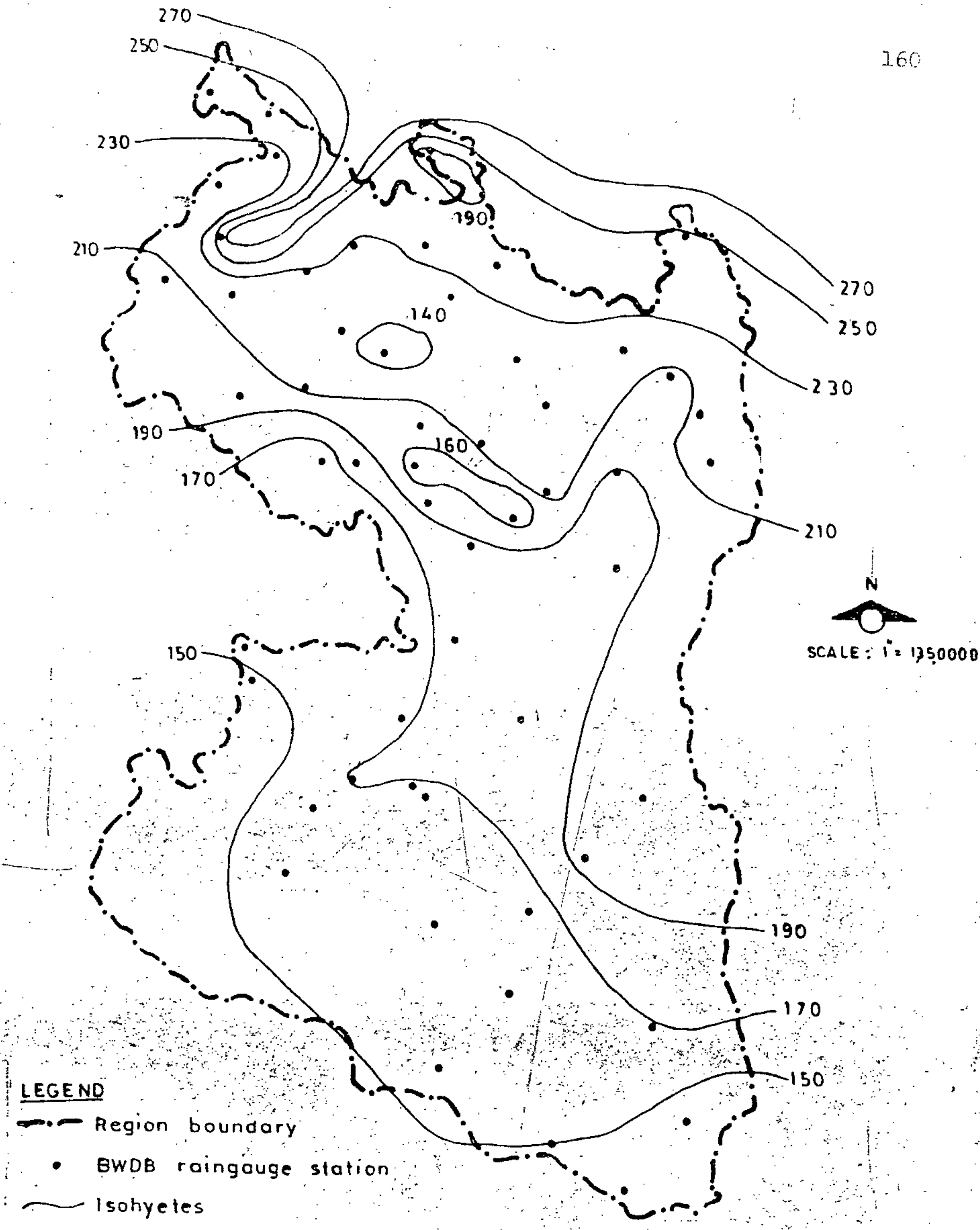


Fig. 31. Generalized isohyetal map of 2-day rainfall having 2 year Return Period (mm.).

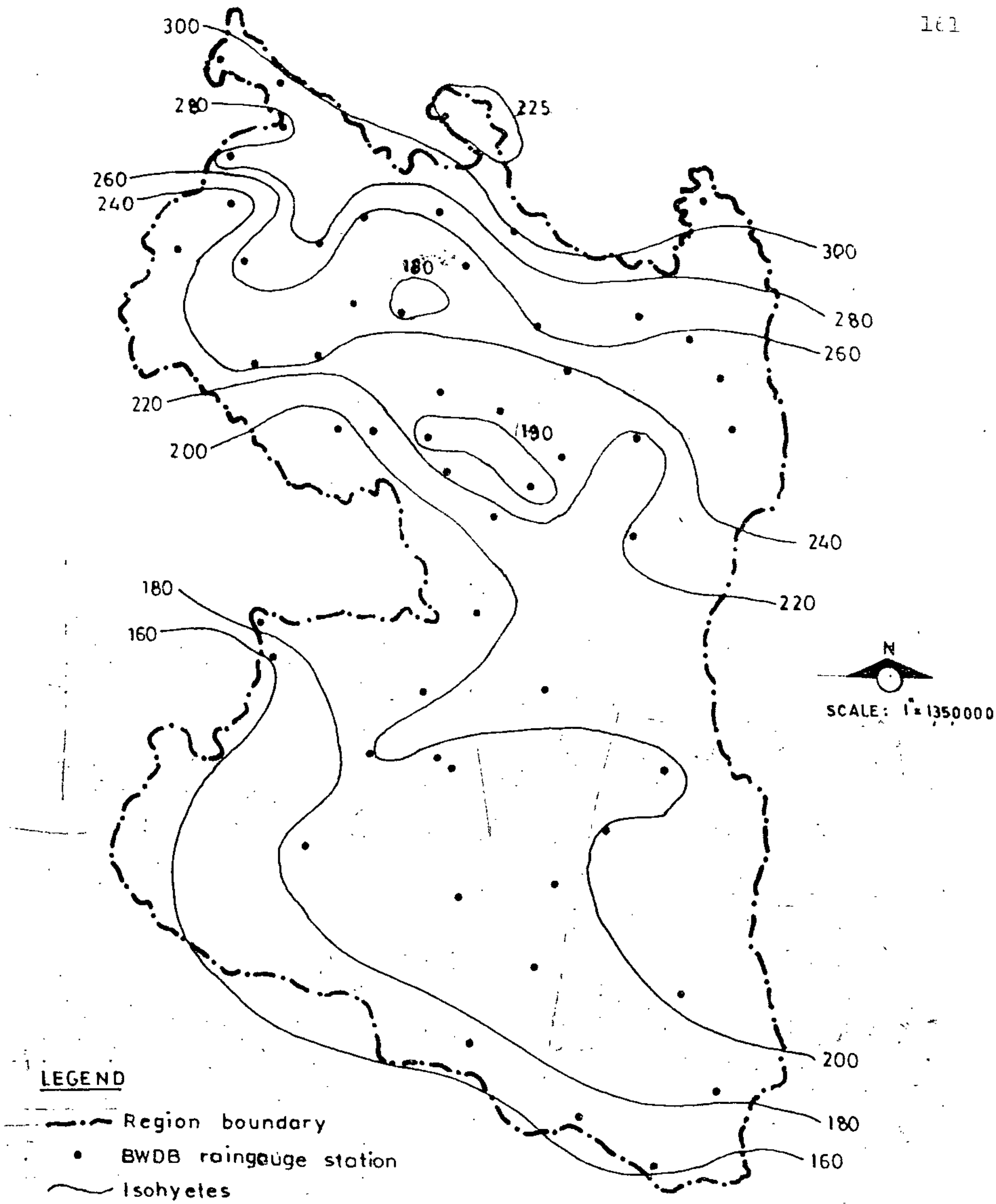


Fig. 32. Generalized isohyetal map of 3-day rainfall having 2 year Return Period (mm.).

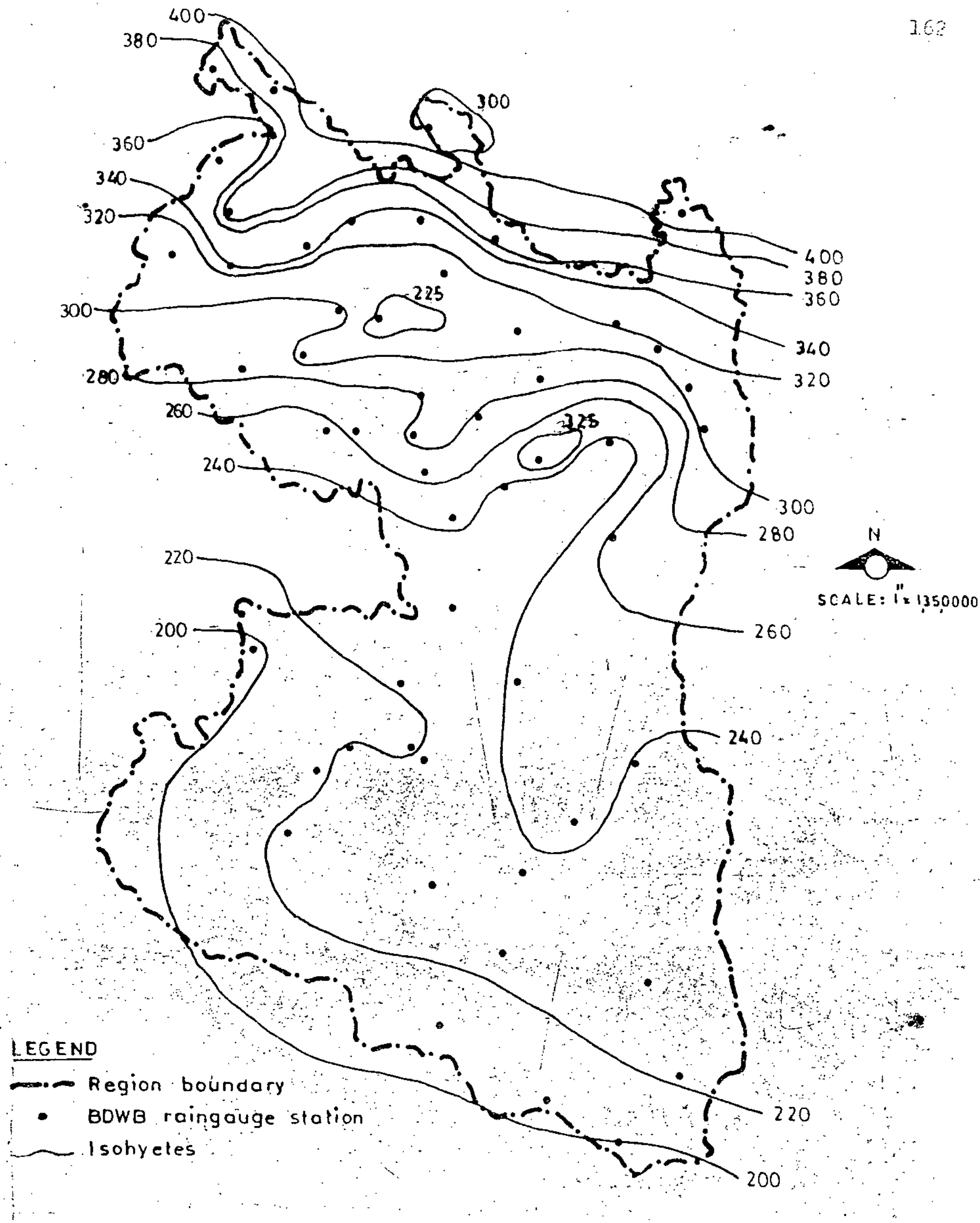


Fig. 33. Generalized isohyetal map of 5-day rainfall having 2 year Return Period (mm.).

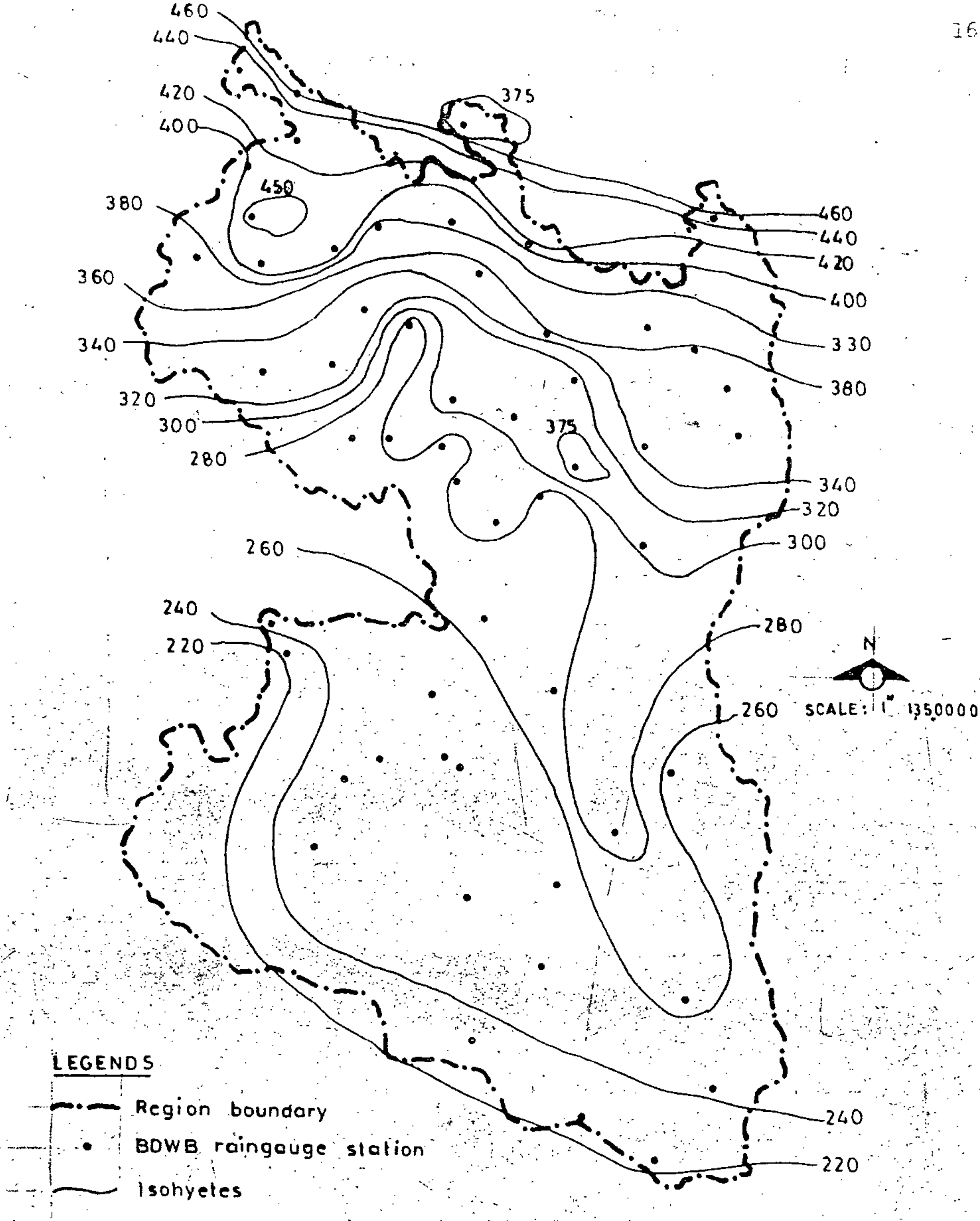


Fig. 34. Generalized isohyetal map of 7-day rainfall having 2 year Return Period. (mm.)

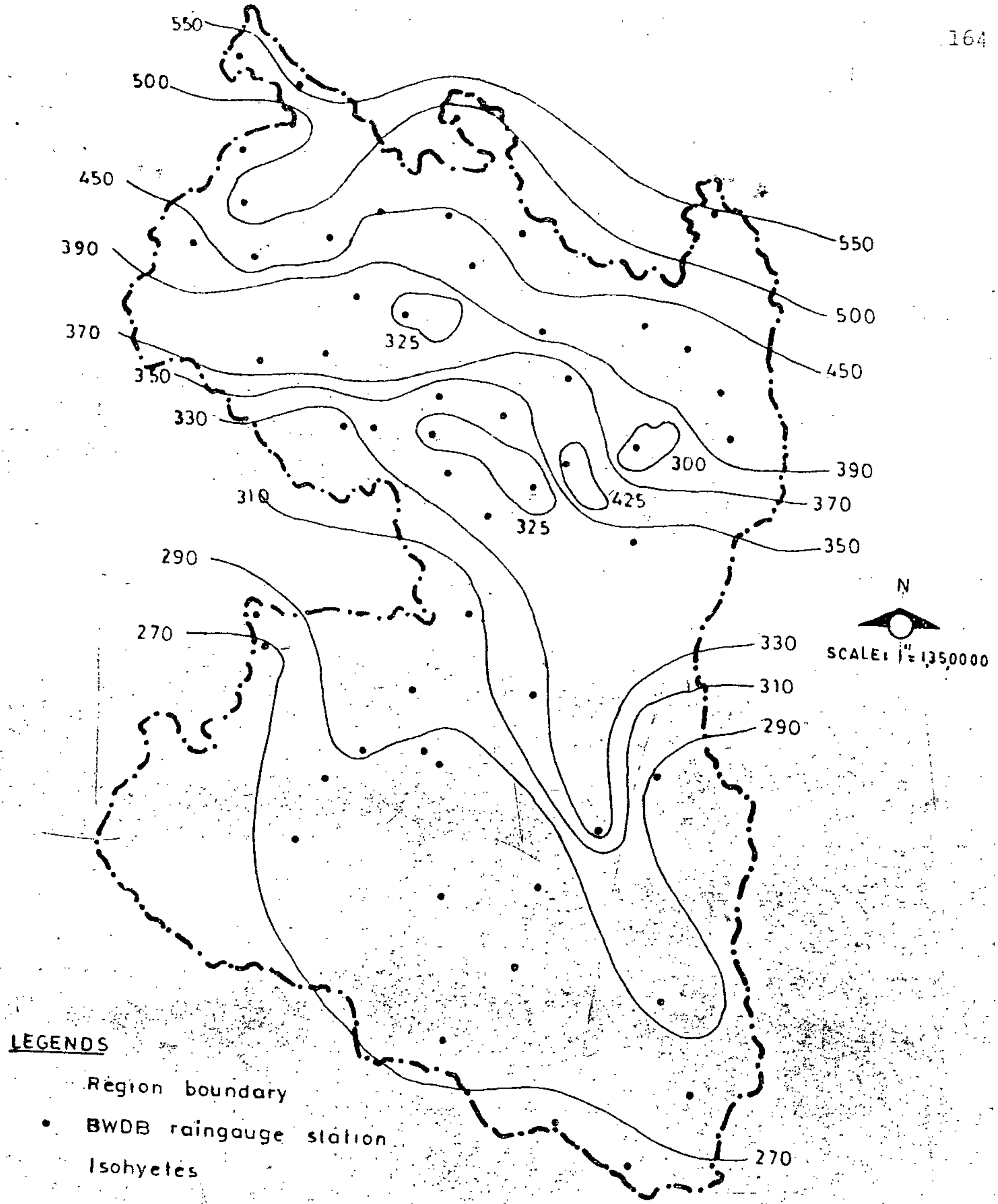


Fig. 35. Generalized isohyetal map of 10-day rainfall having 2 year Return Period (mm.).

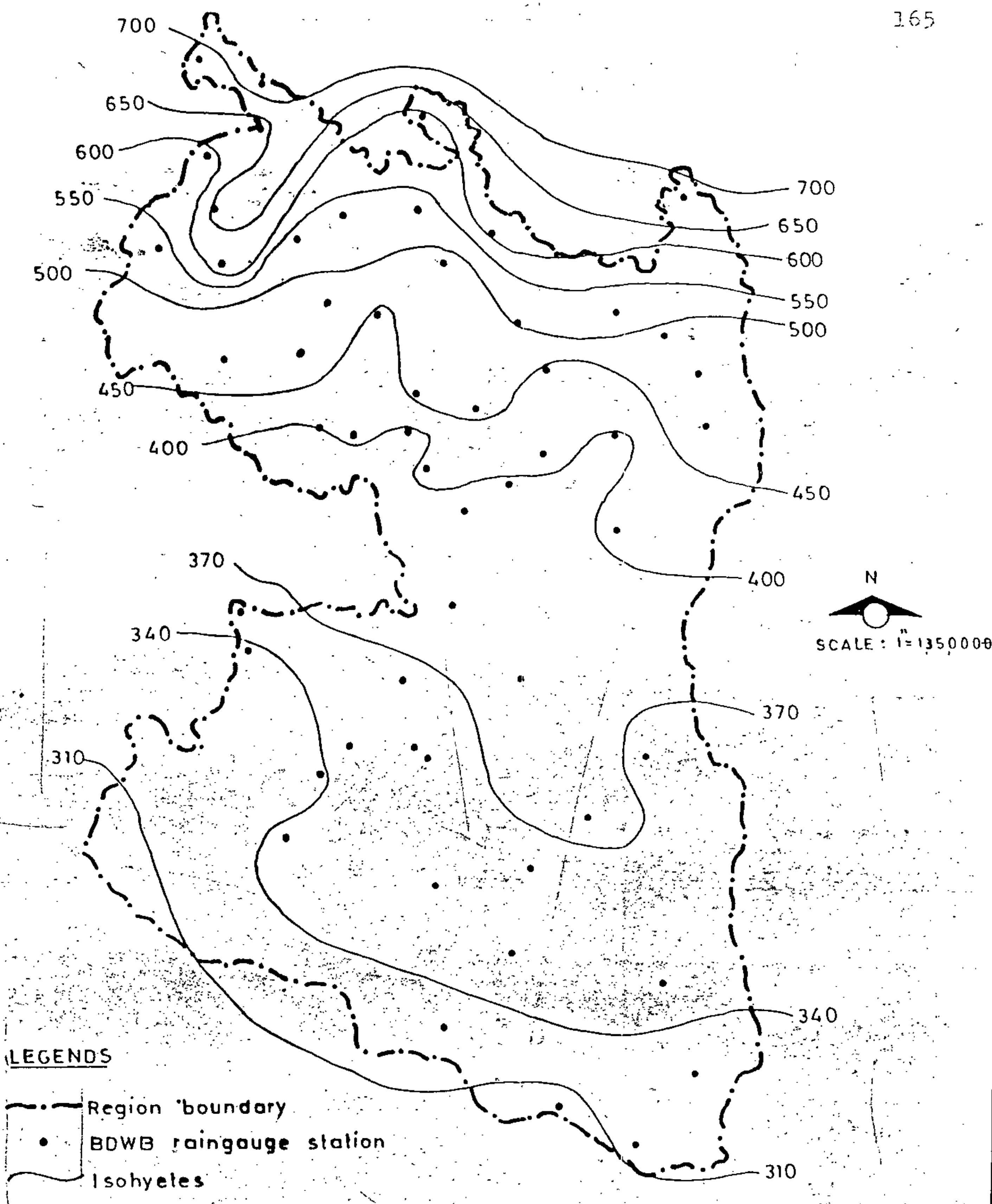


Fig. 36. Generalized isohyetal map of 15-day rainfall having 2 year Return Period. (mm.)

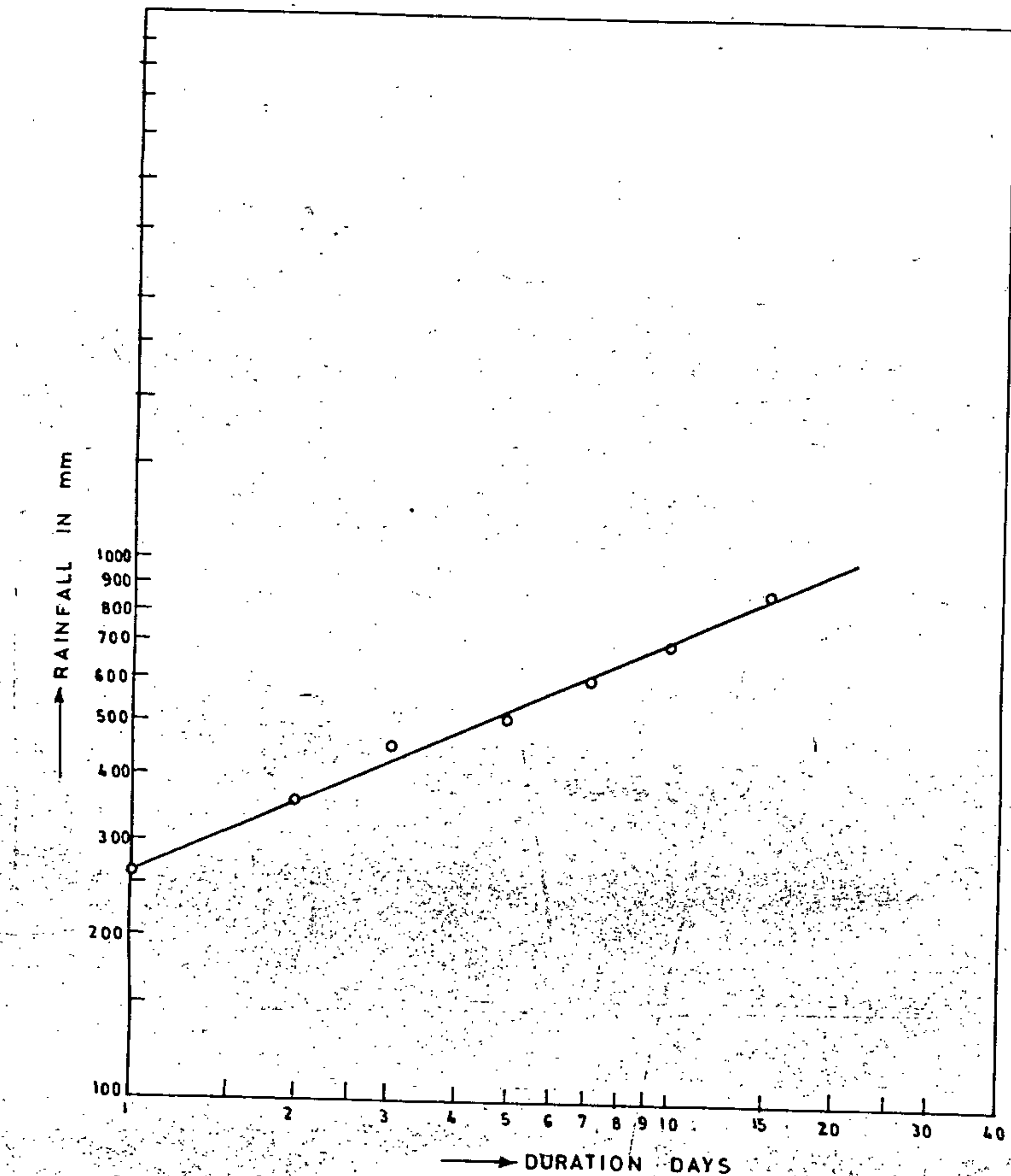


Fig. 37. Typical plotting through the enveloping points.
(Return period 5 years).

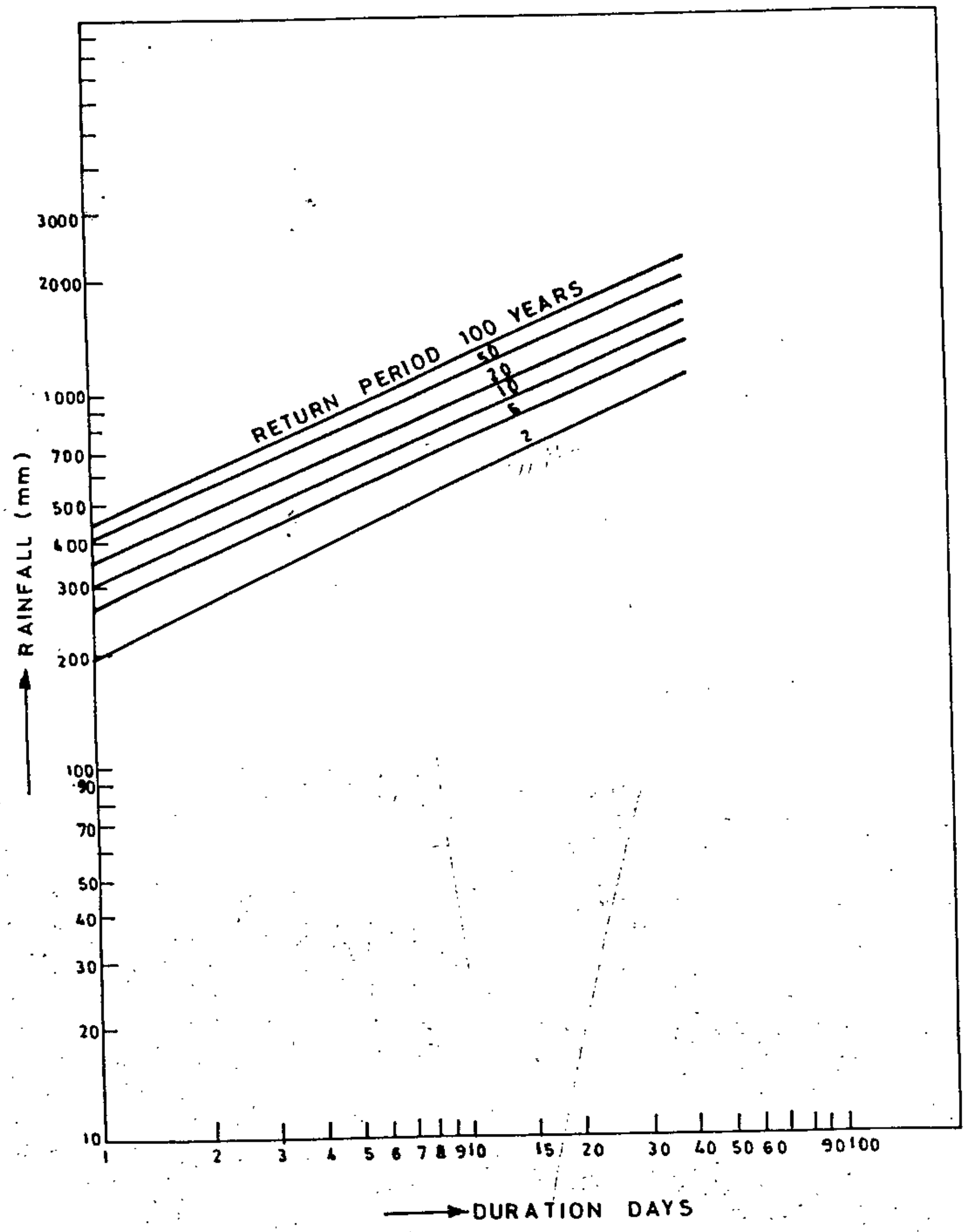


Fig. 38. Generalized depth-duration-frequency curves for the north-west region of Bangladesh .

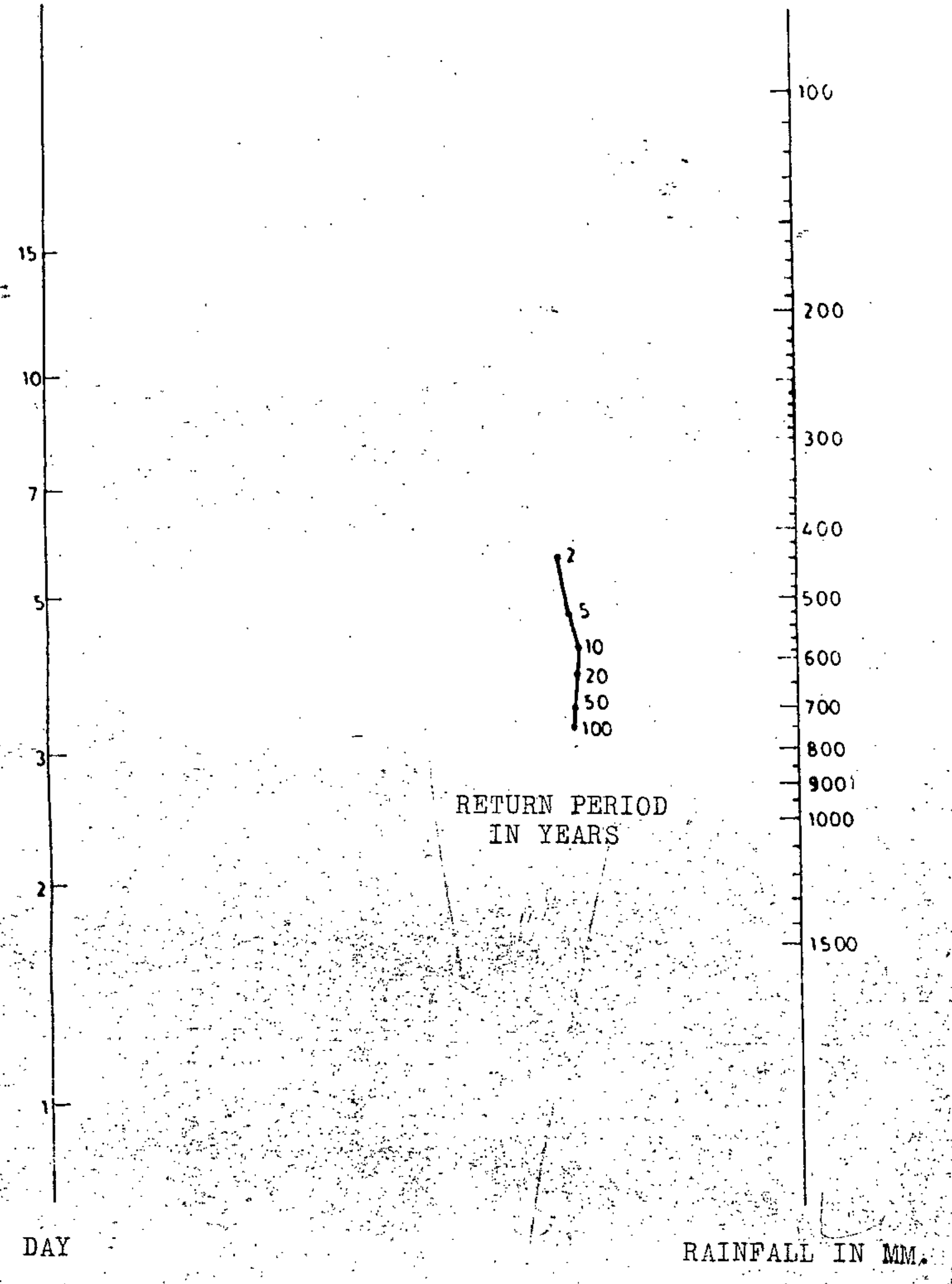


Fig. 39. Generalized depth-duration-frequency nomograph for north west region of Bangladesh.

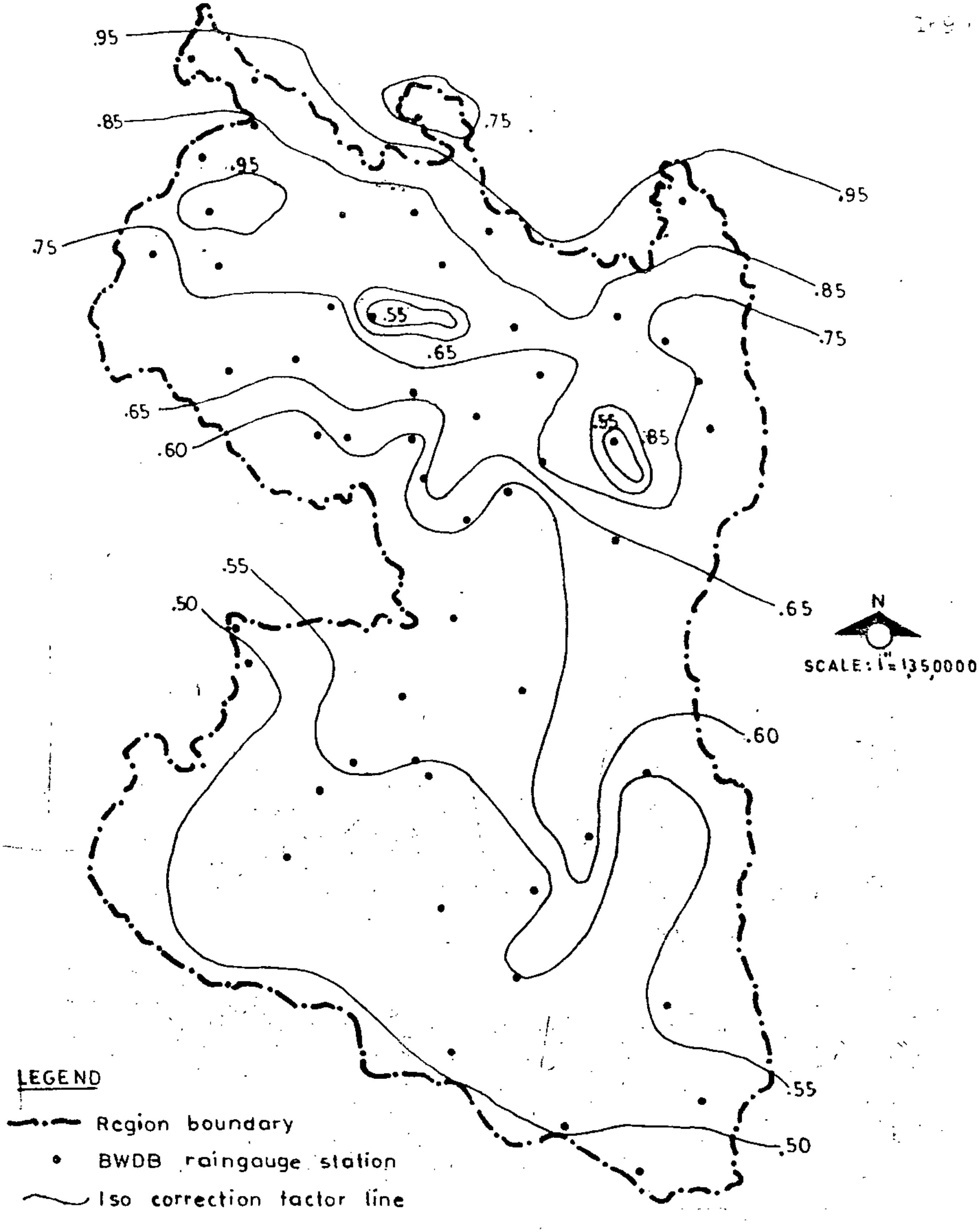


Fig. 40. Chart giving the value of correction factor for 2 year Return Period.

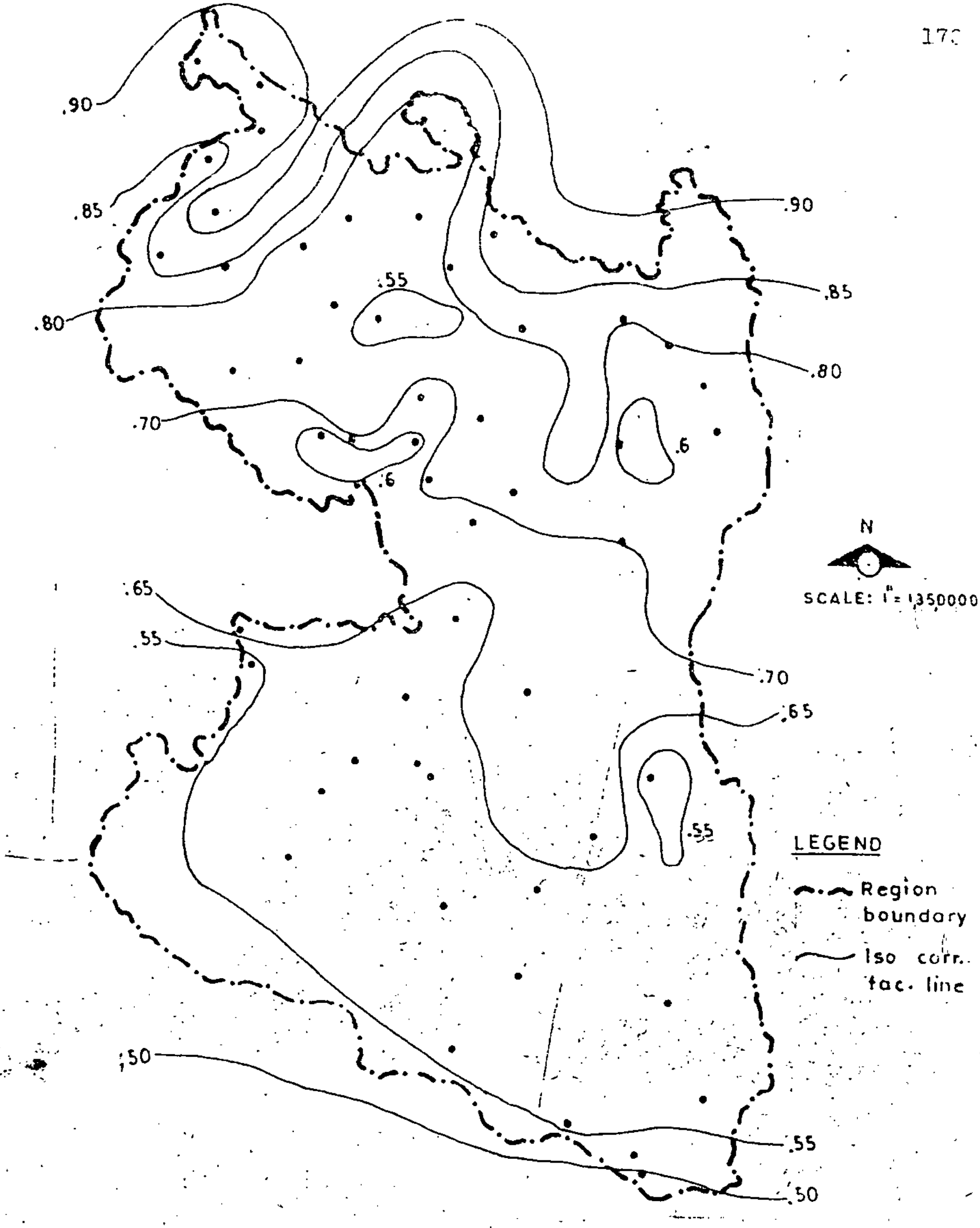


Fig. 41. Chart giving the value of correction factor for 5 year Return Period.

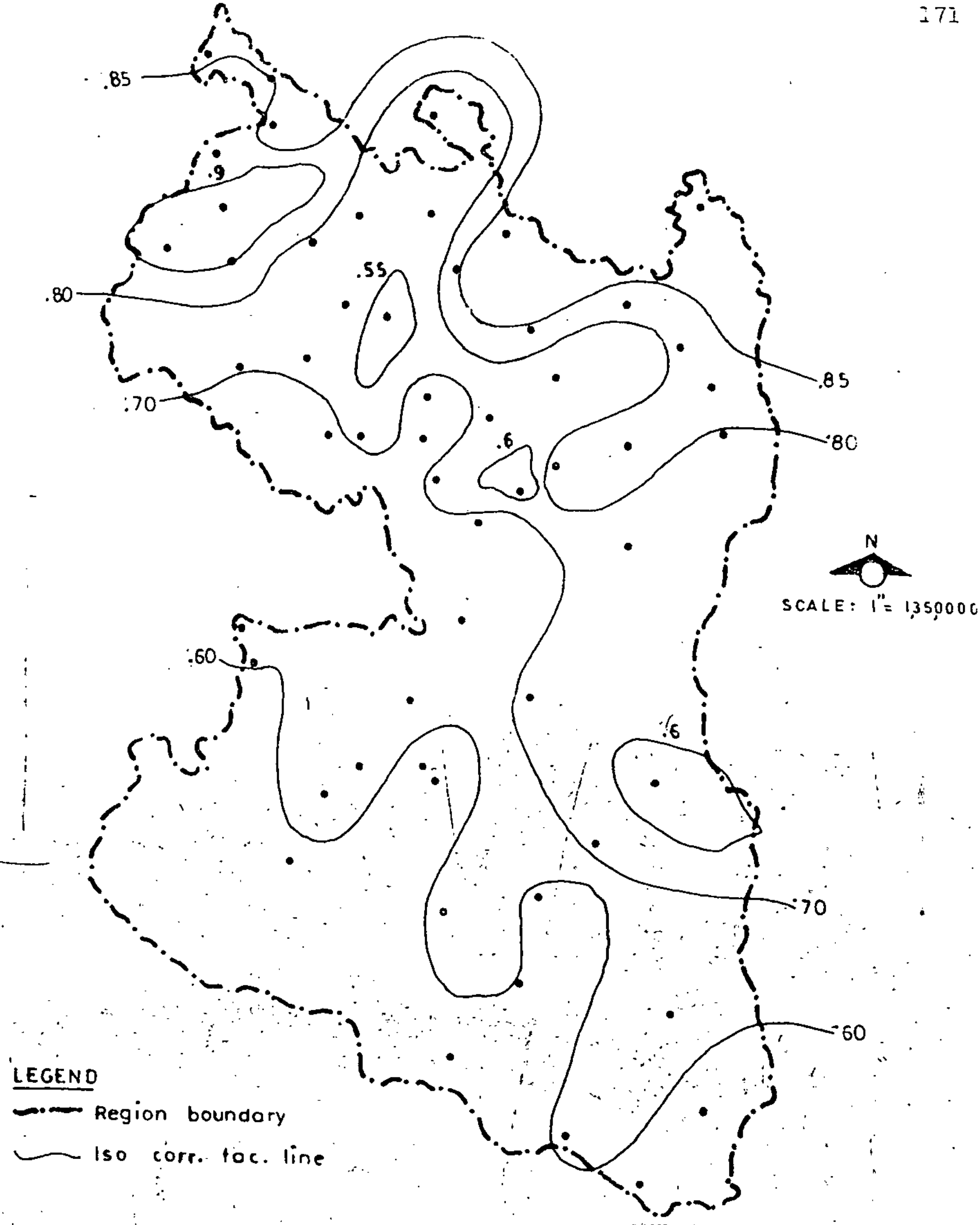


Fig. 42. Chart giving the value of correction factor for 10 year Return Period.

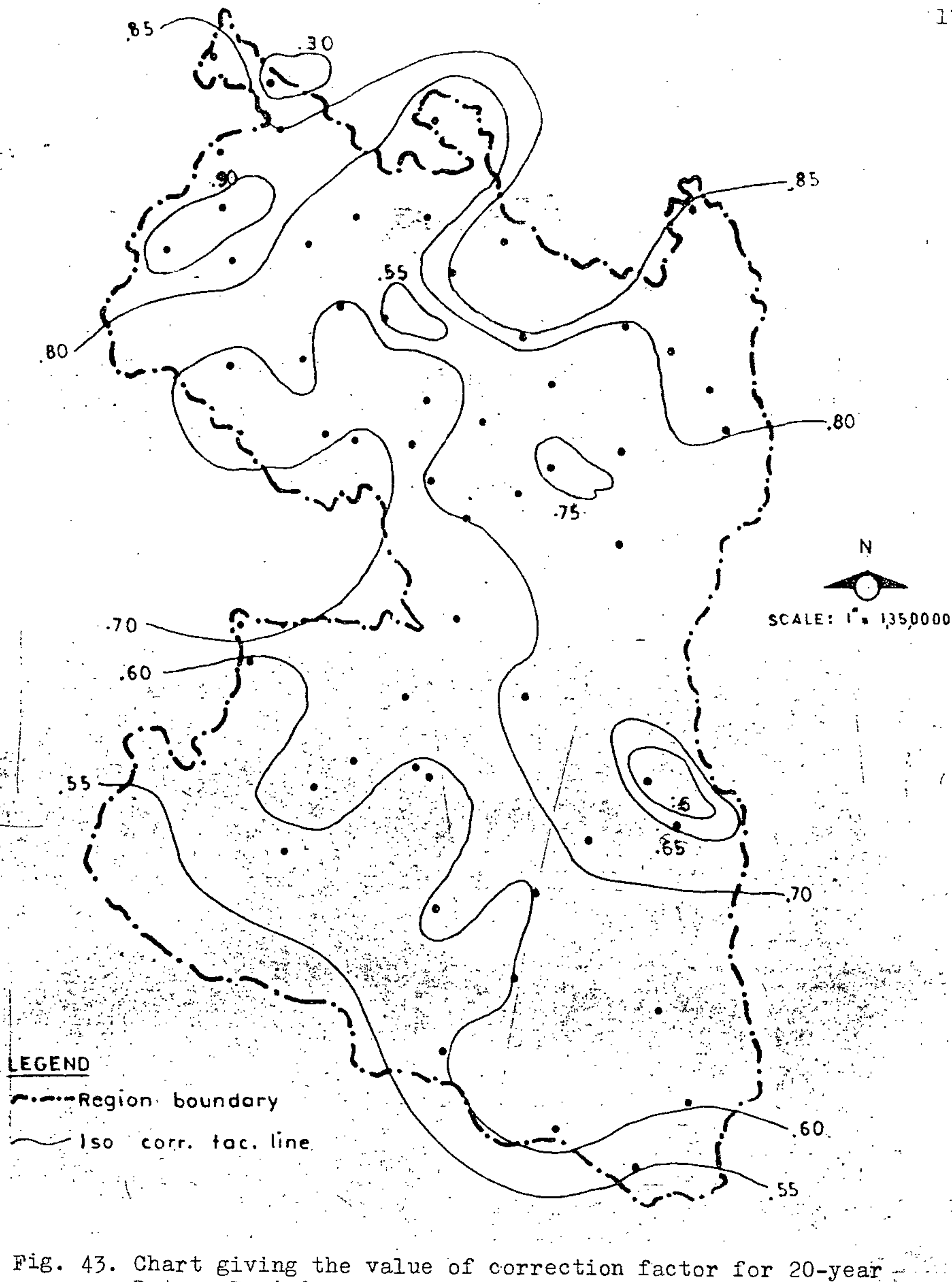


Fig. 43. Chart giving the value of correction factor for 20-year Return Period.

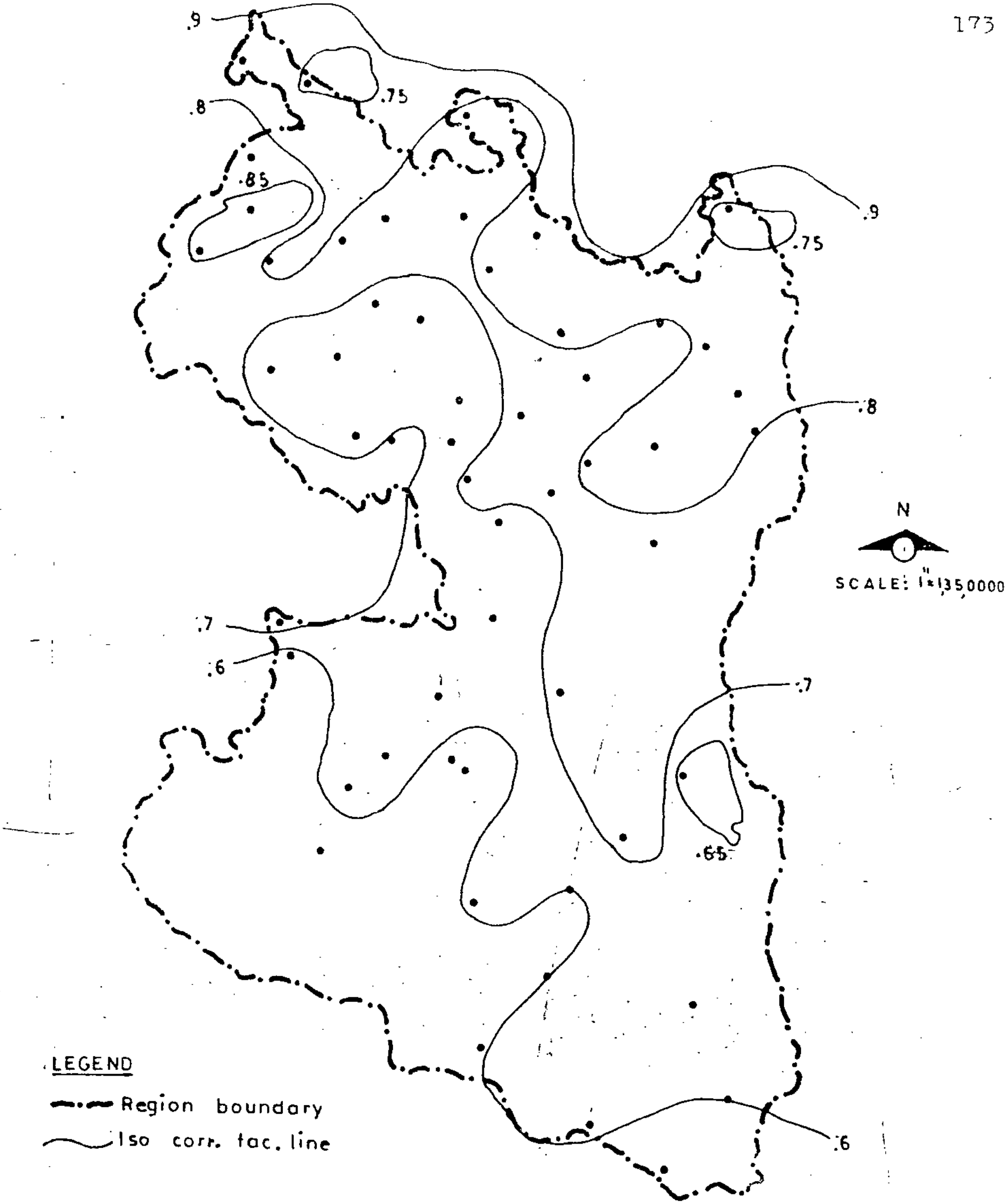


Fig. 44. Chart giving the value of correction factor for 50 year Return Period.

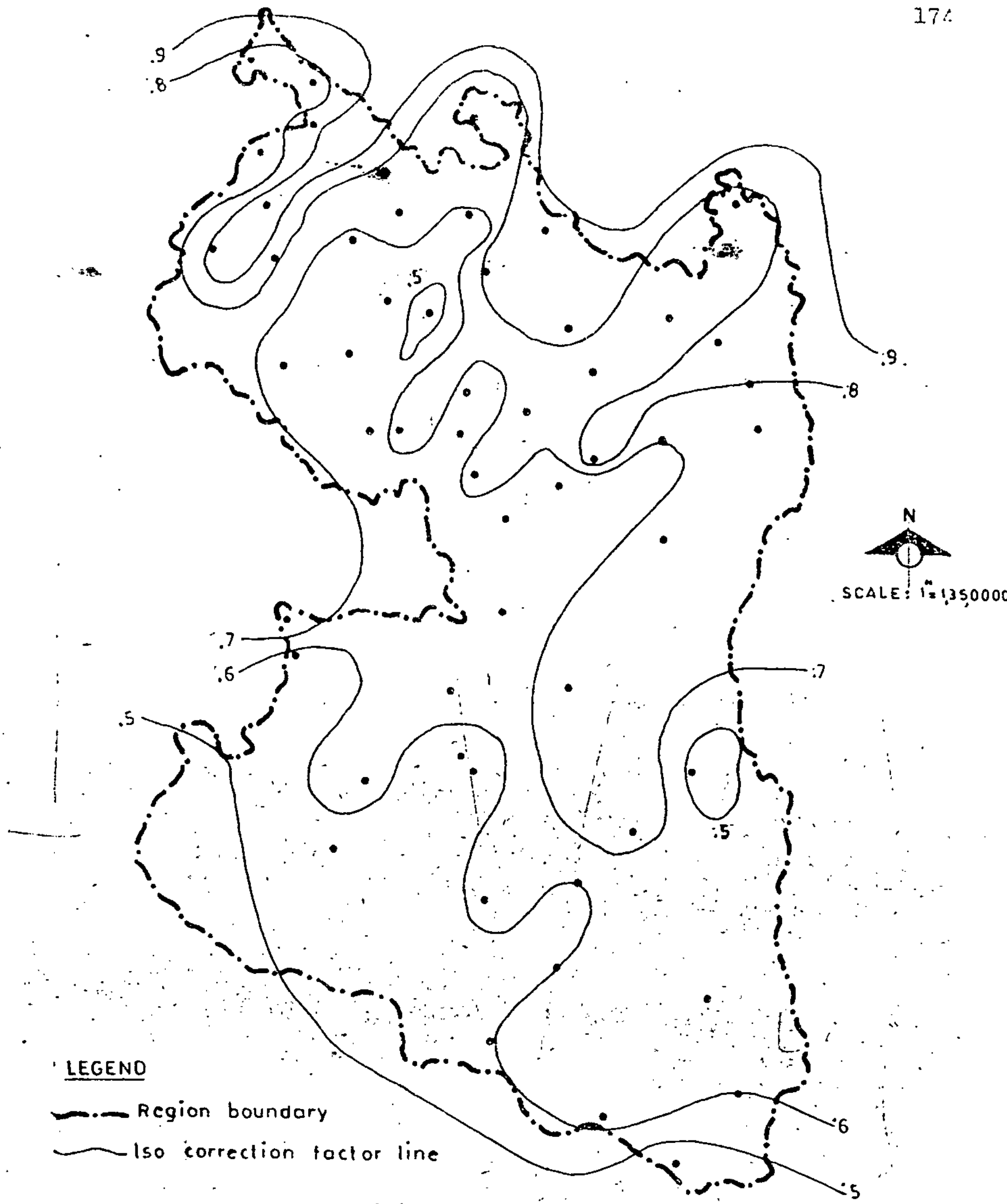


Fig. 45. Chart giving the value of correction factor for 100 year Return Period.

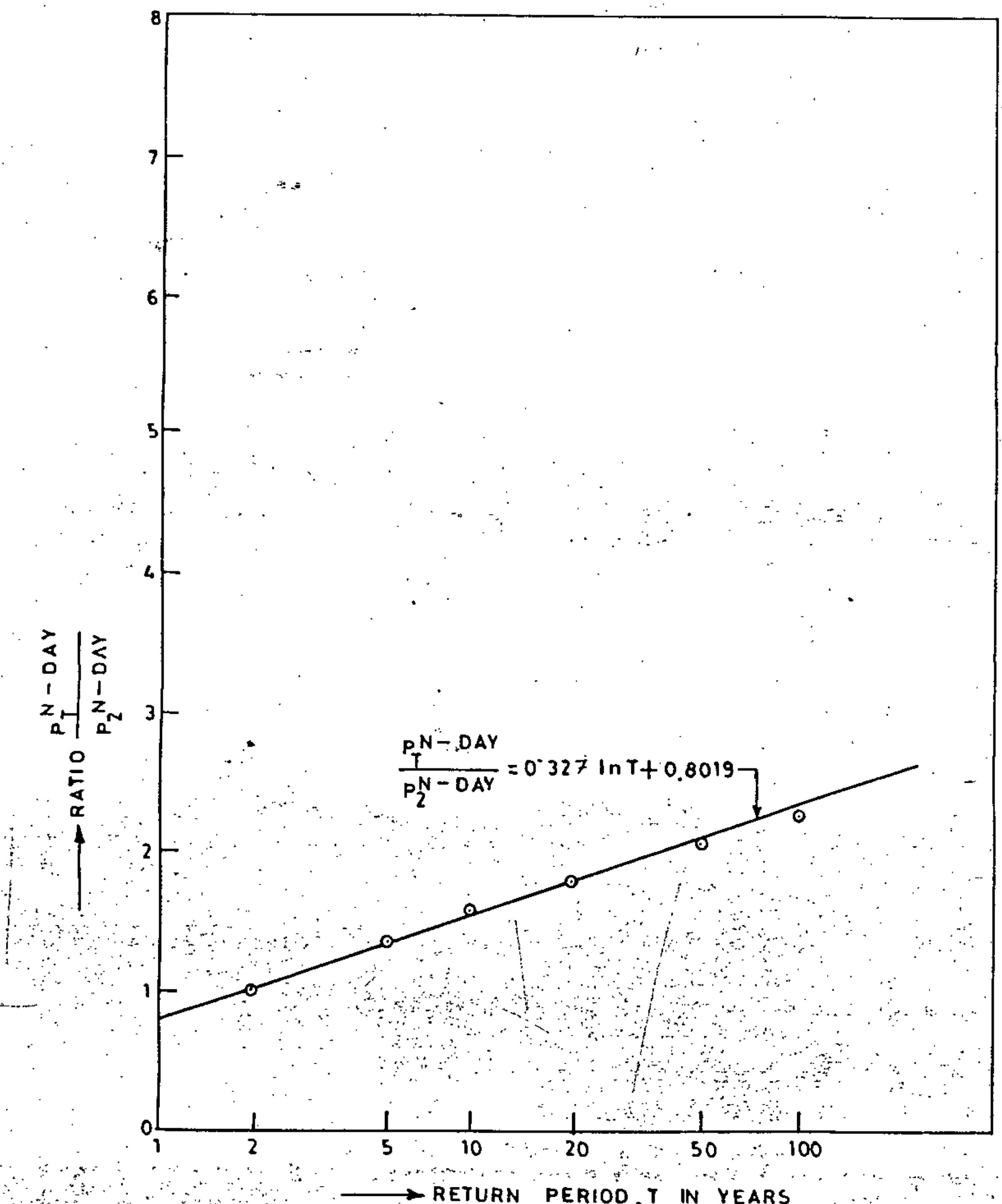


Fig. 46. Ratio of $\frac{P_T^{N-DAY}}{P_2^{N-DAY}}$ as a function of Return Period for the north west region og Bangladesh.

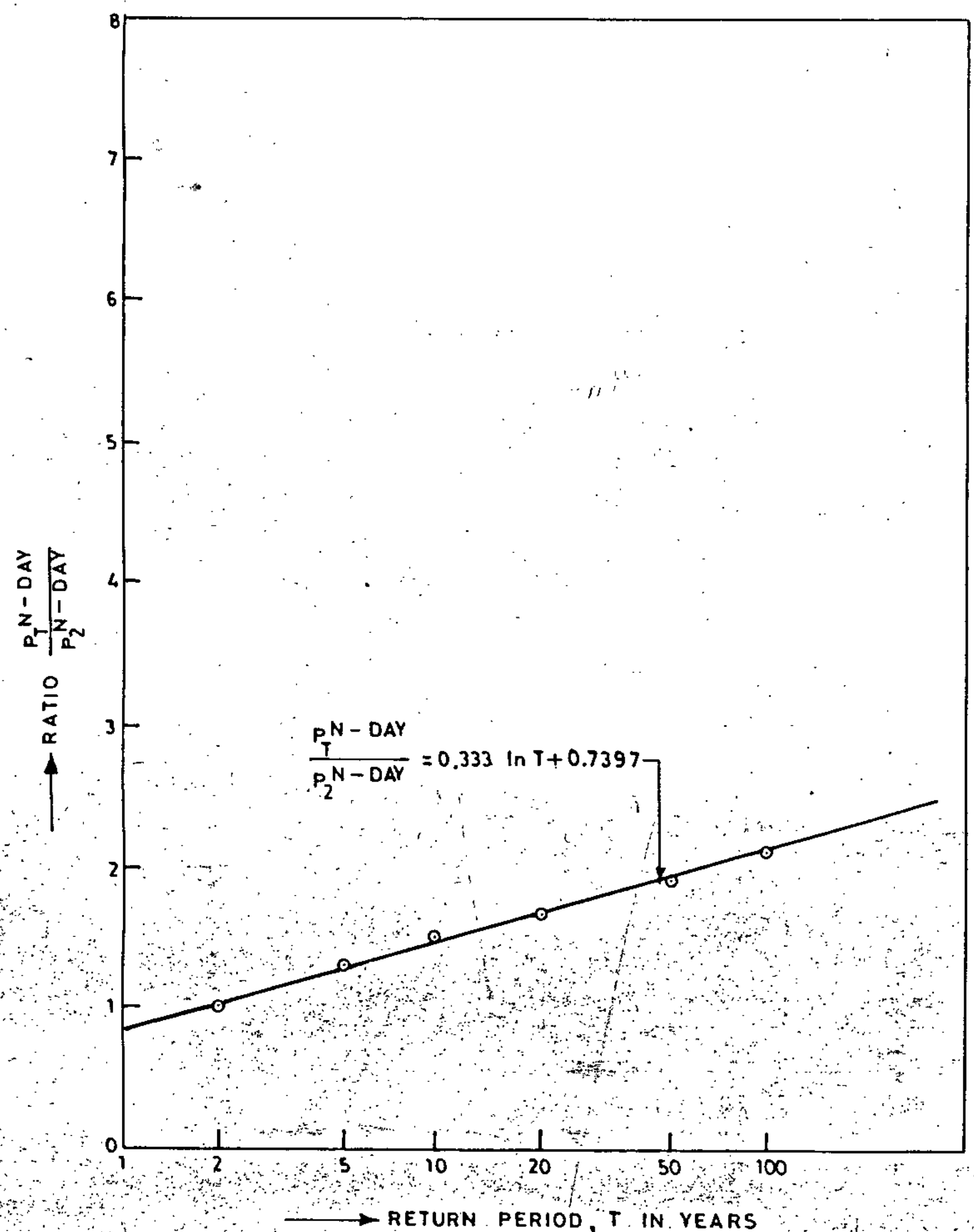


Fig. 47. Ratio of $\frac{P_T^{N-DAY}}{P_2^{N-DAY}}$ as a function of Return Period for (MPO) hydrological unit no. 1.

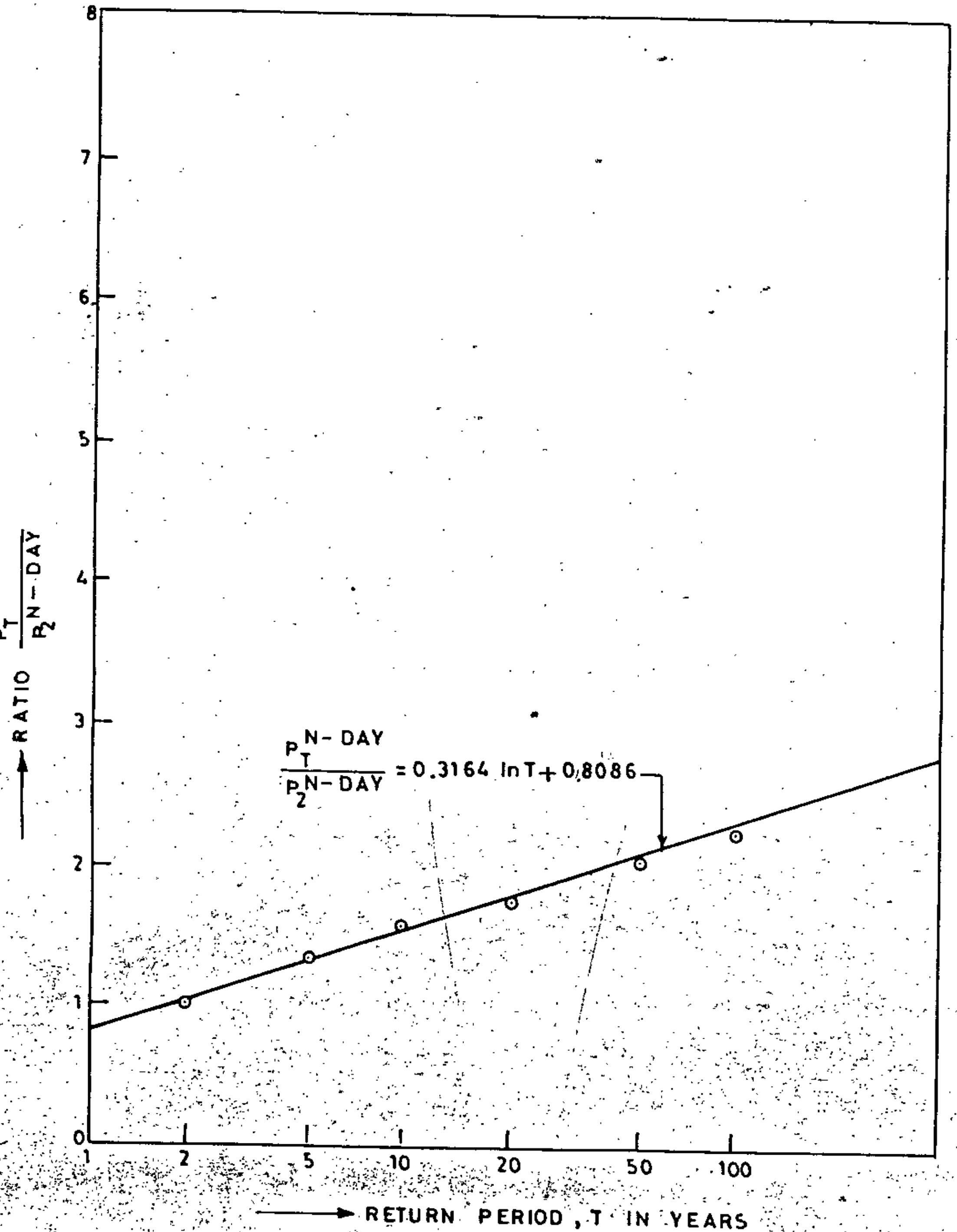


Fig. 48. Ratio of $\frac{P_T^{N-DAY}}{P_2^{N-DAY}}$ as a function of Return Period for (MPO) hydrological unit no. 2.

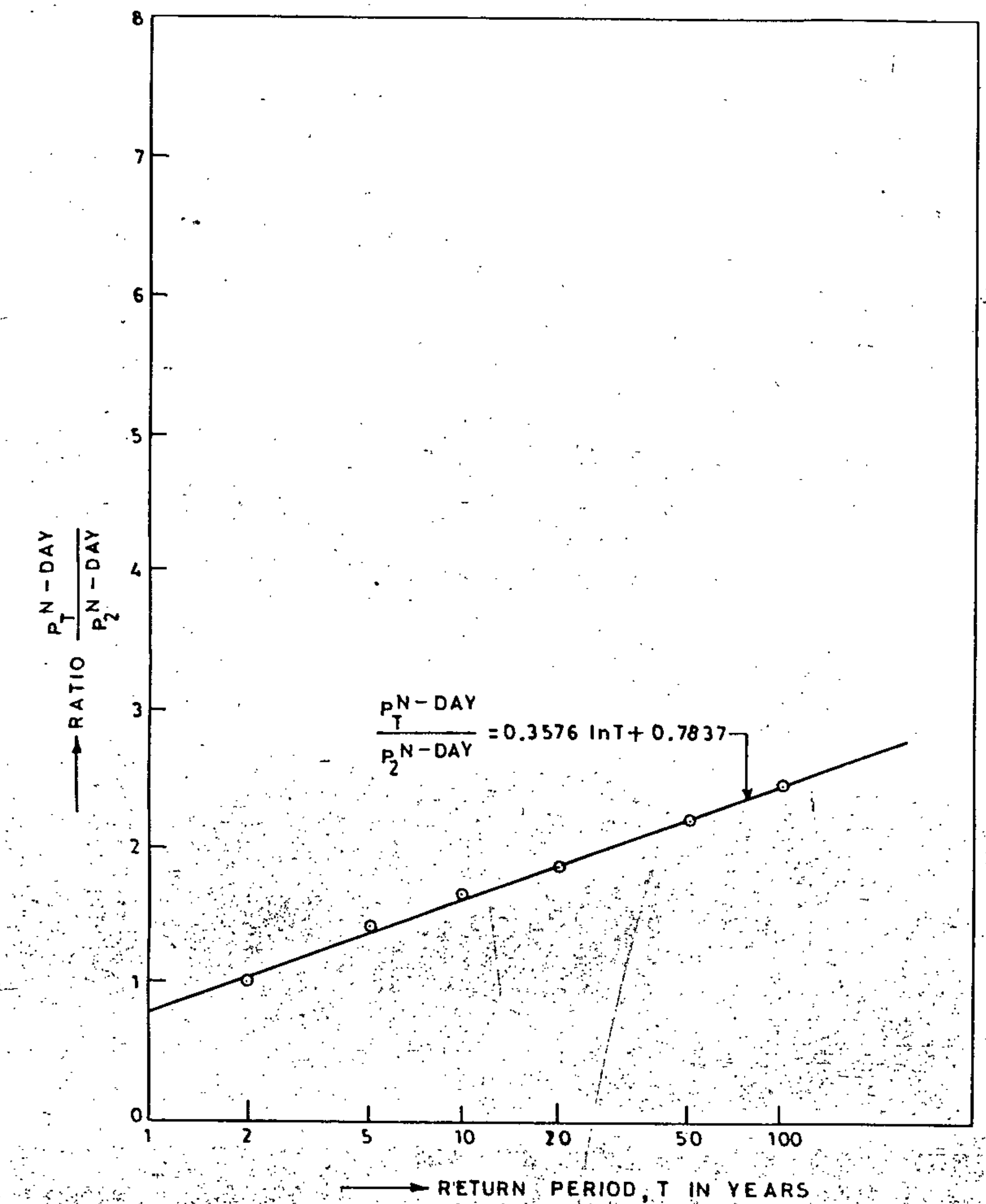


Fig. 49. Ratio of $\frac{P_T^{N-DAY}}{P_2^{N-DAY}}$ as a function of Return Period for (MPO) hydrological unit no. 3.

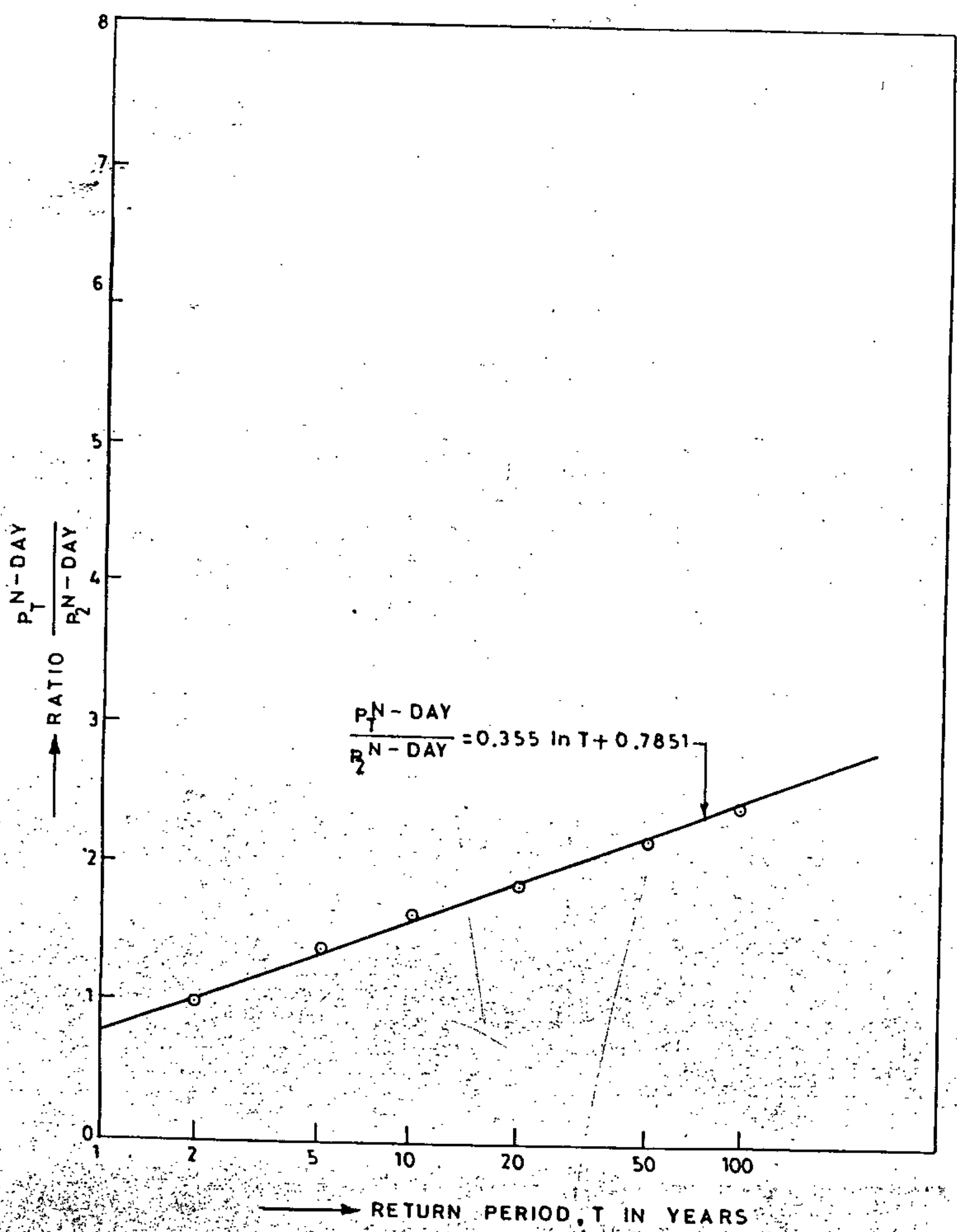


Fig. 50. Ratio of $\frac{P_T^{N-DAY}}{P_2^{N-DAY}}$ as a function of Return Period for (MPO) hydrological unit no. 4.

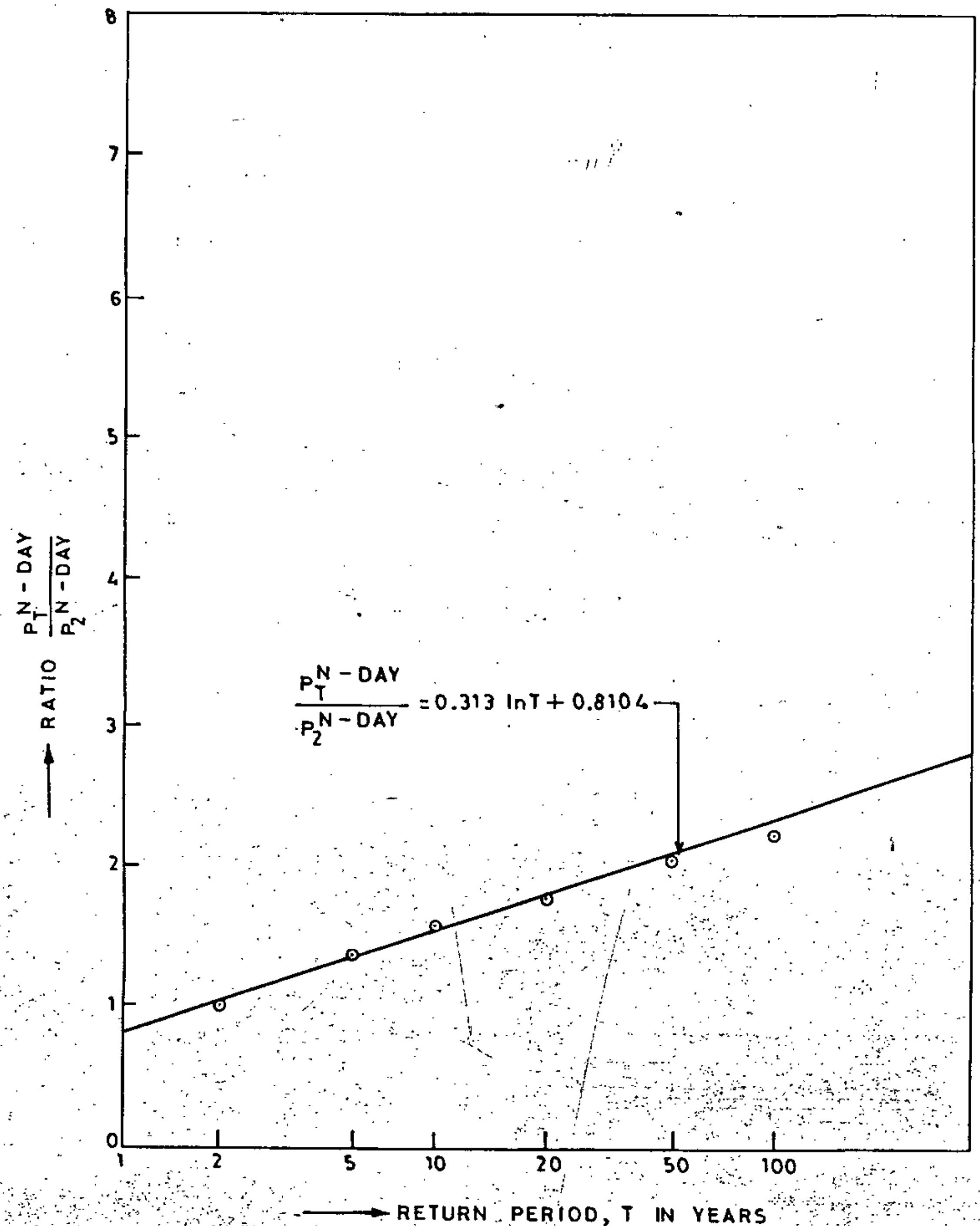


Fig. 51. Ratio of $\frac{P_T^{N-DAY}}{P_2^{N-DAY}}$ as a function of Return Period for (MPO) hydrological unit no. 5.

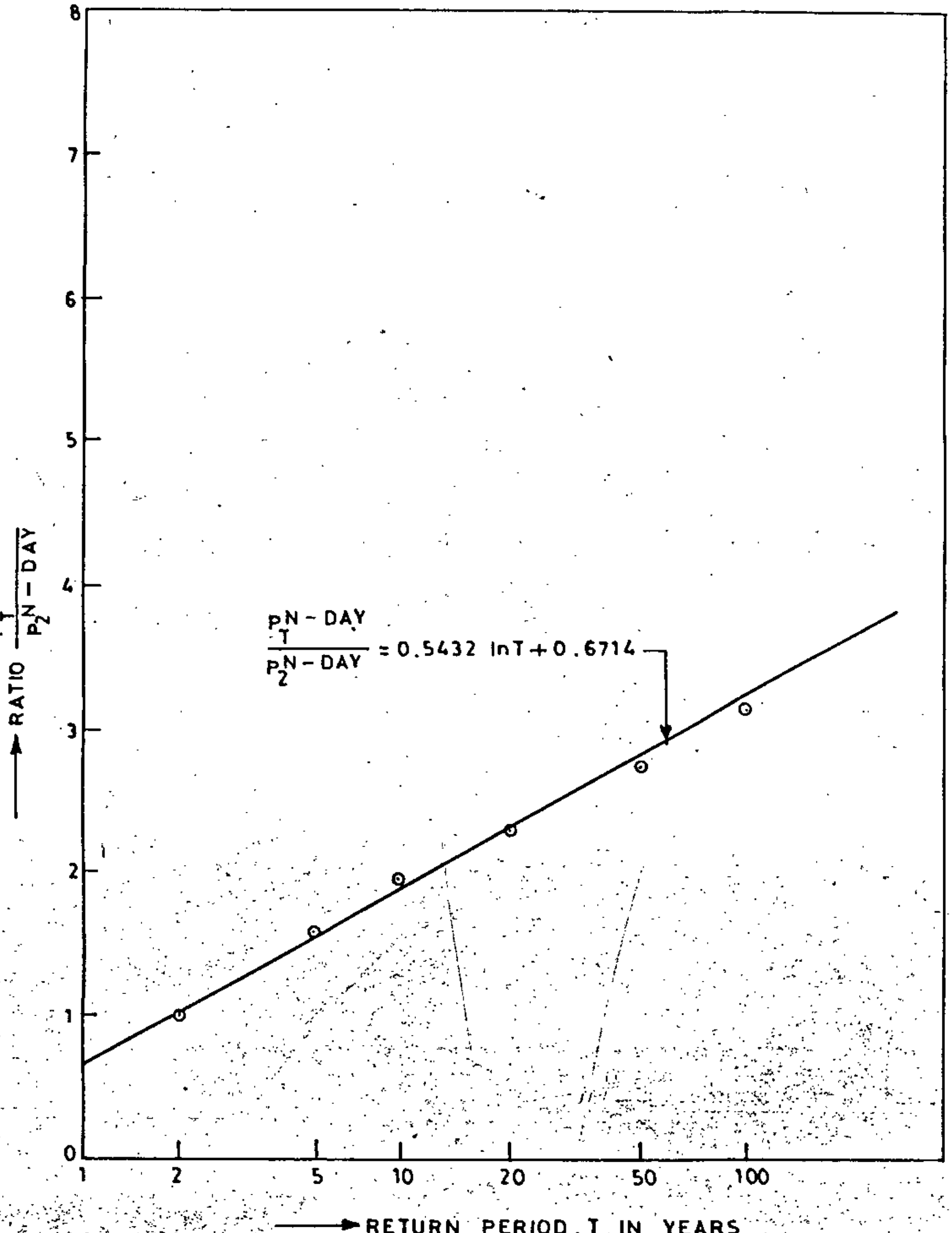


Fig. 52. Ratio of $\frac{P_T^{N-DAY}}{P_2^{N-DAY}}$ as a function of Return Period for (MPO) hydrological unit no. 6.

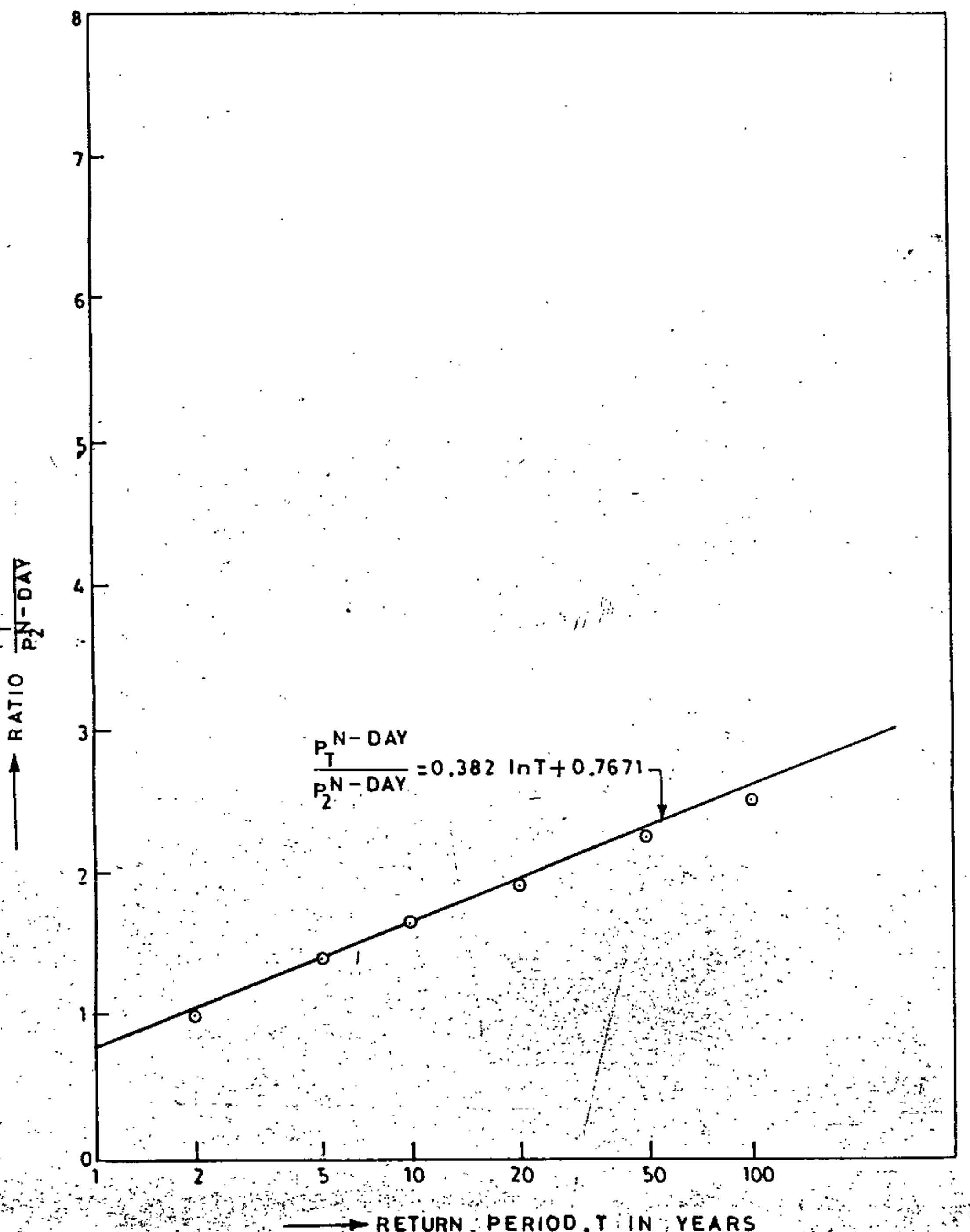


Fig. 53. Ratio of $\frac{P_T^{N-DAY}}{P_2^{N-DAY}}$ as a function of Return Period for (MPO) hydrological unit no. 7 .

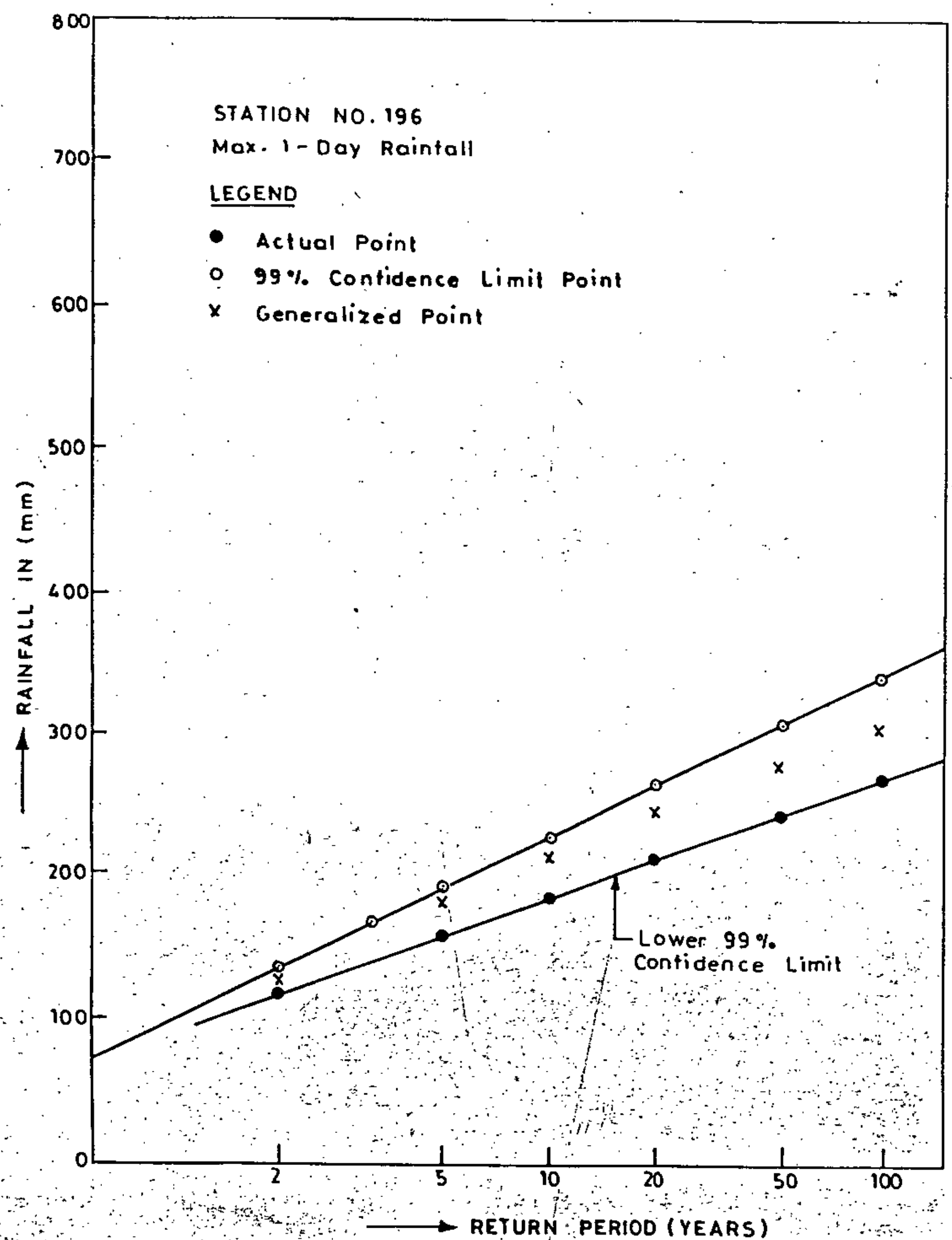


Fig. 54. Typical result of testing.

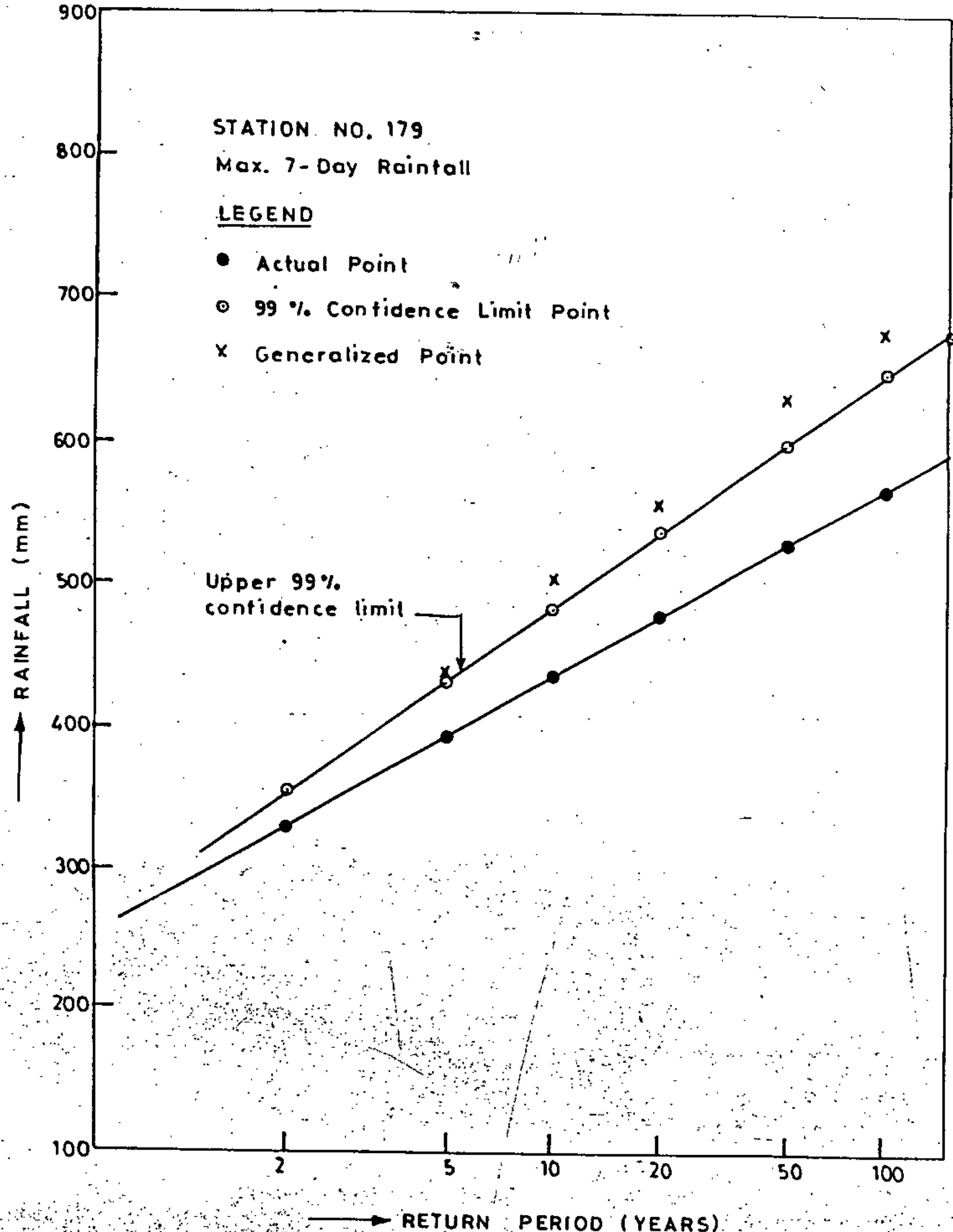


Fig. 55. Typical result of testing.

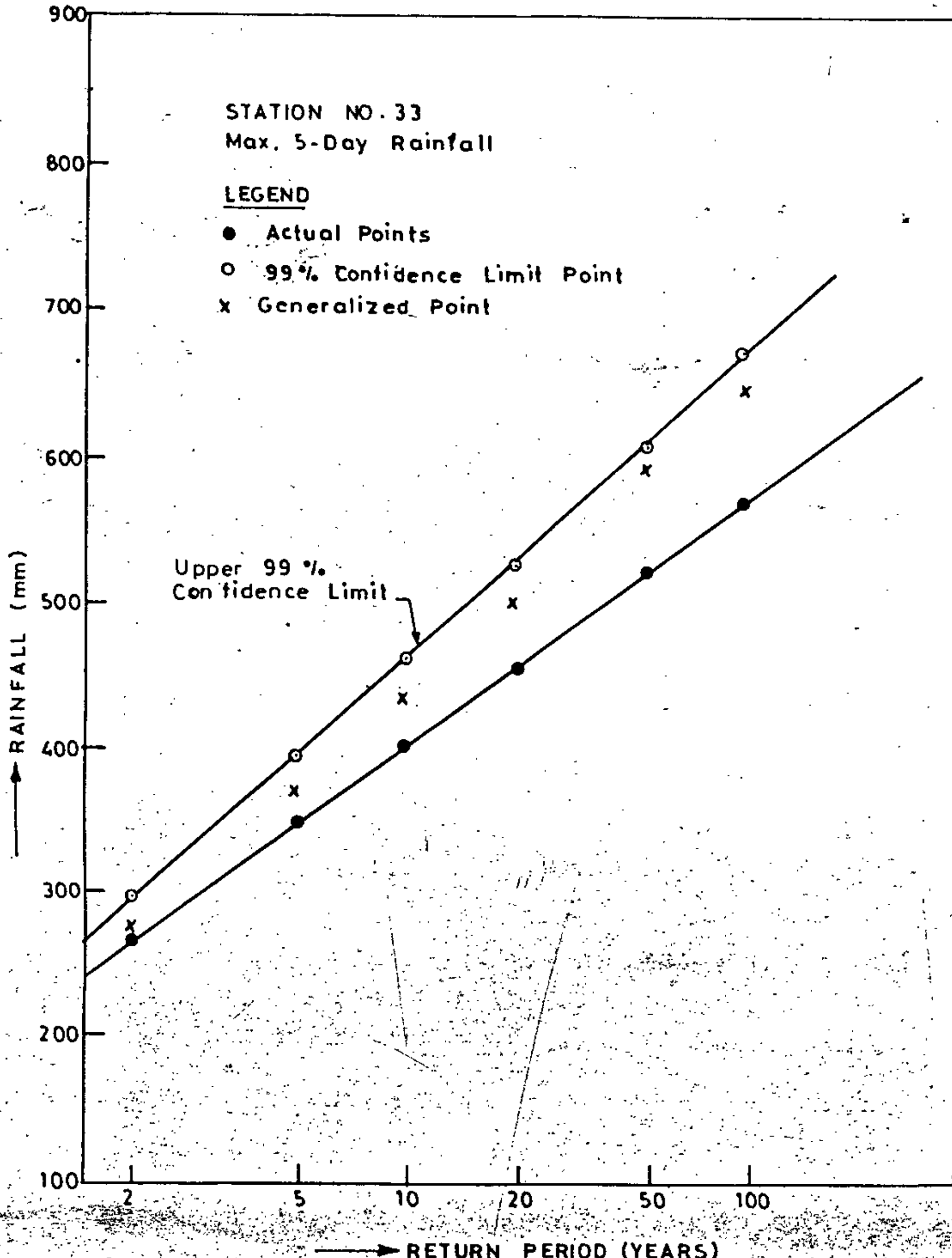


Fig. 56. Typical result of testing.

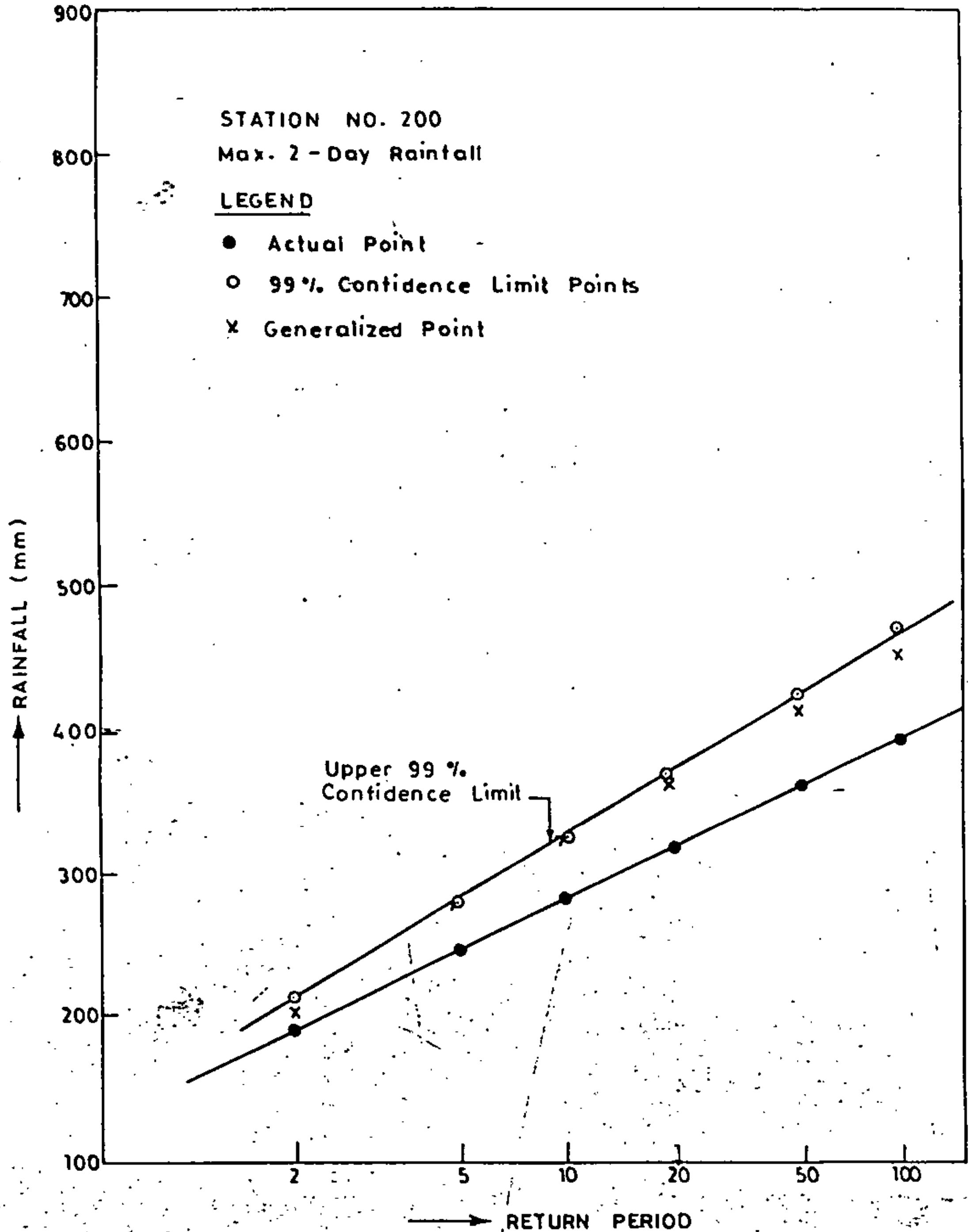


Fig. 57. Typical result of testing.

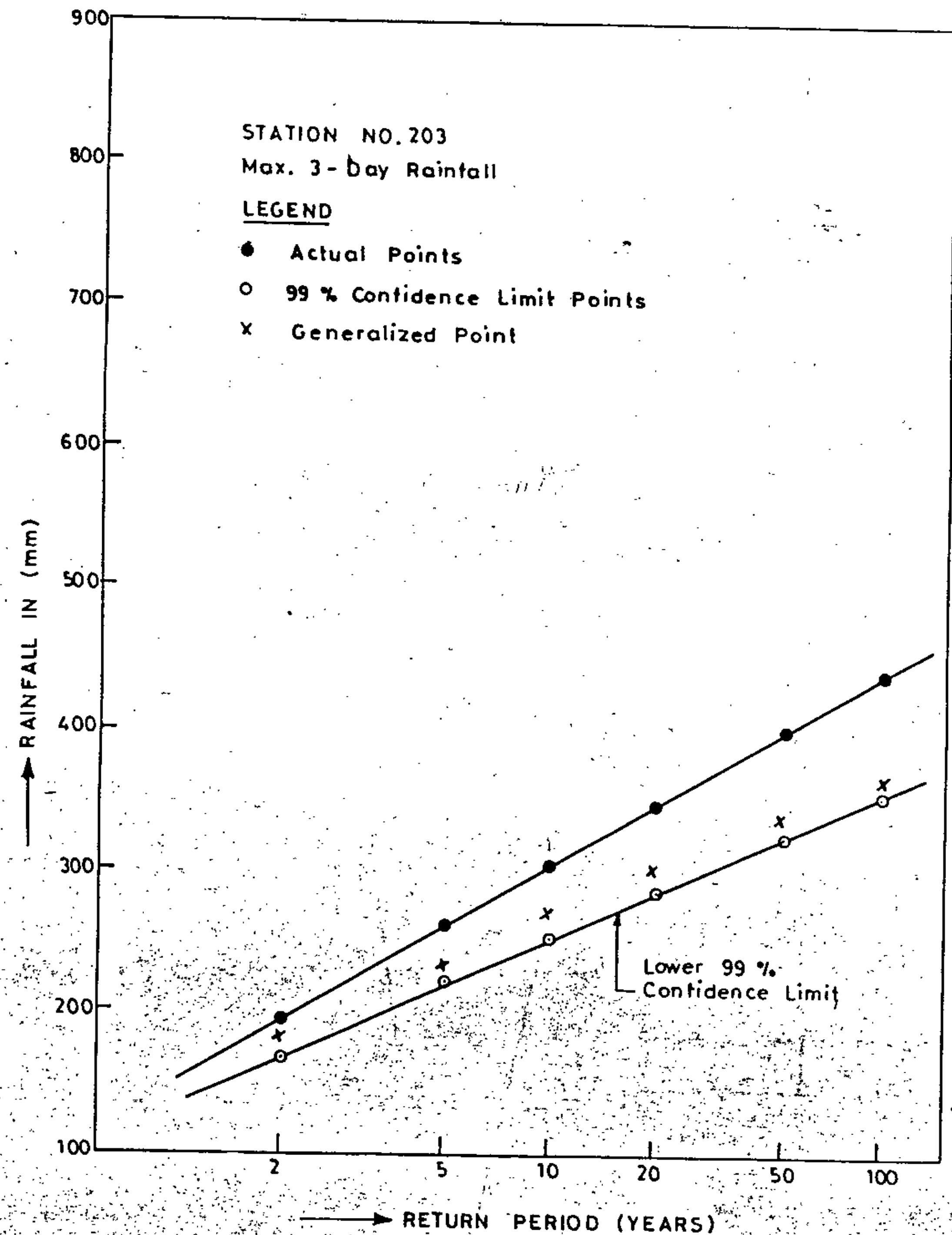


Fig. 58. Typical result of testing.

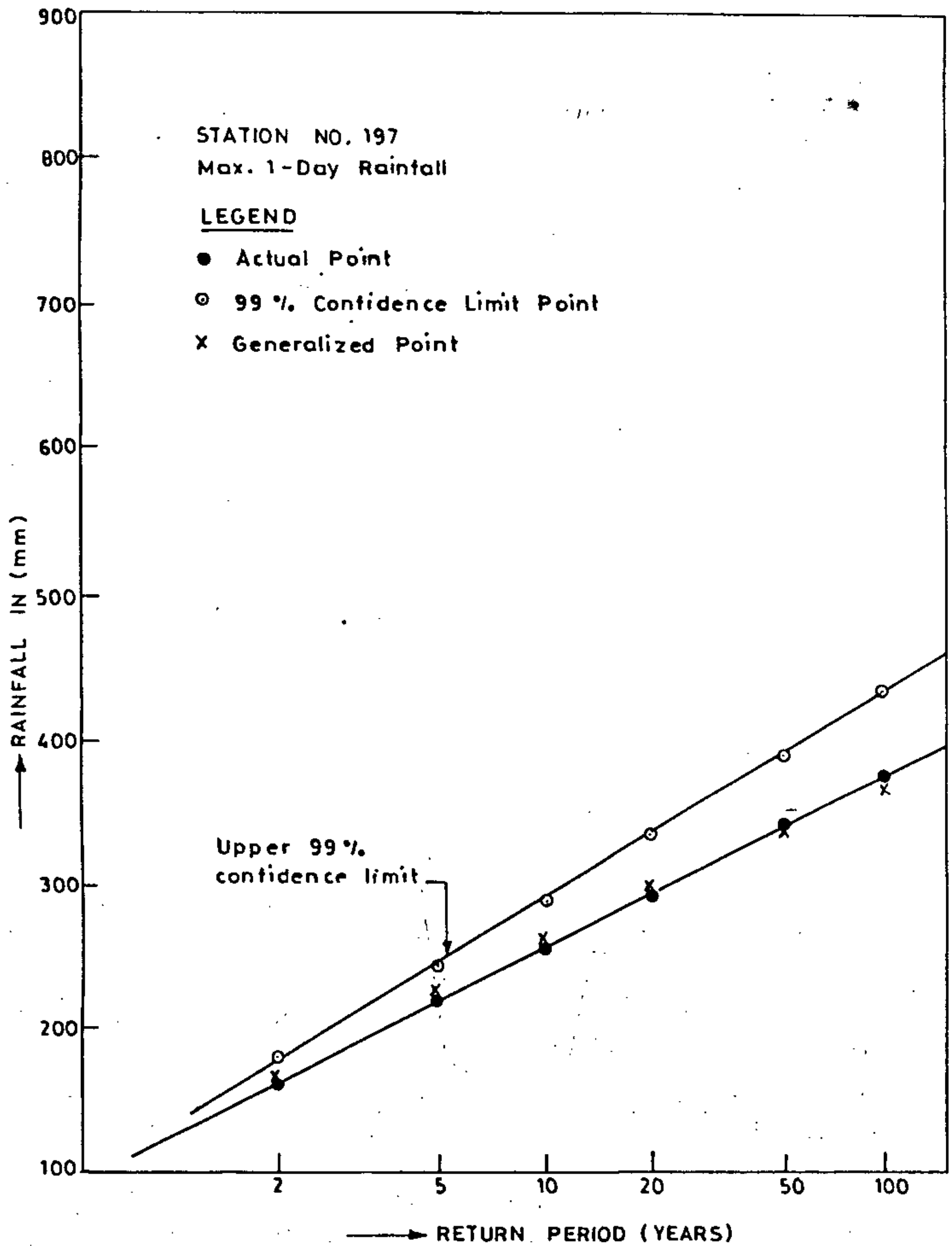


Fig. 59. Typical result of testing.

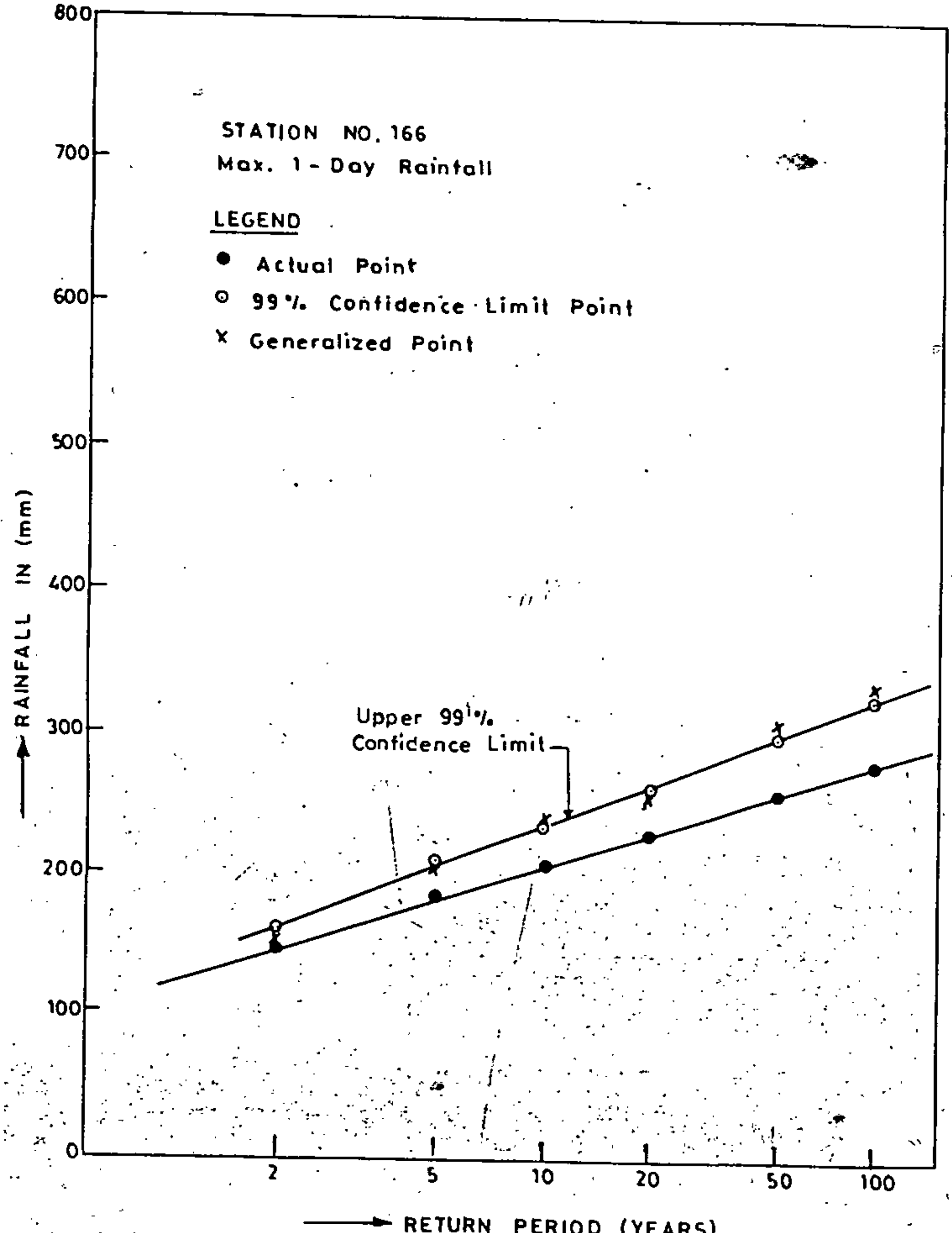


Fig. 60. Typical result of testing.

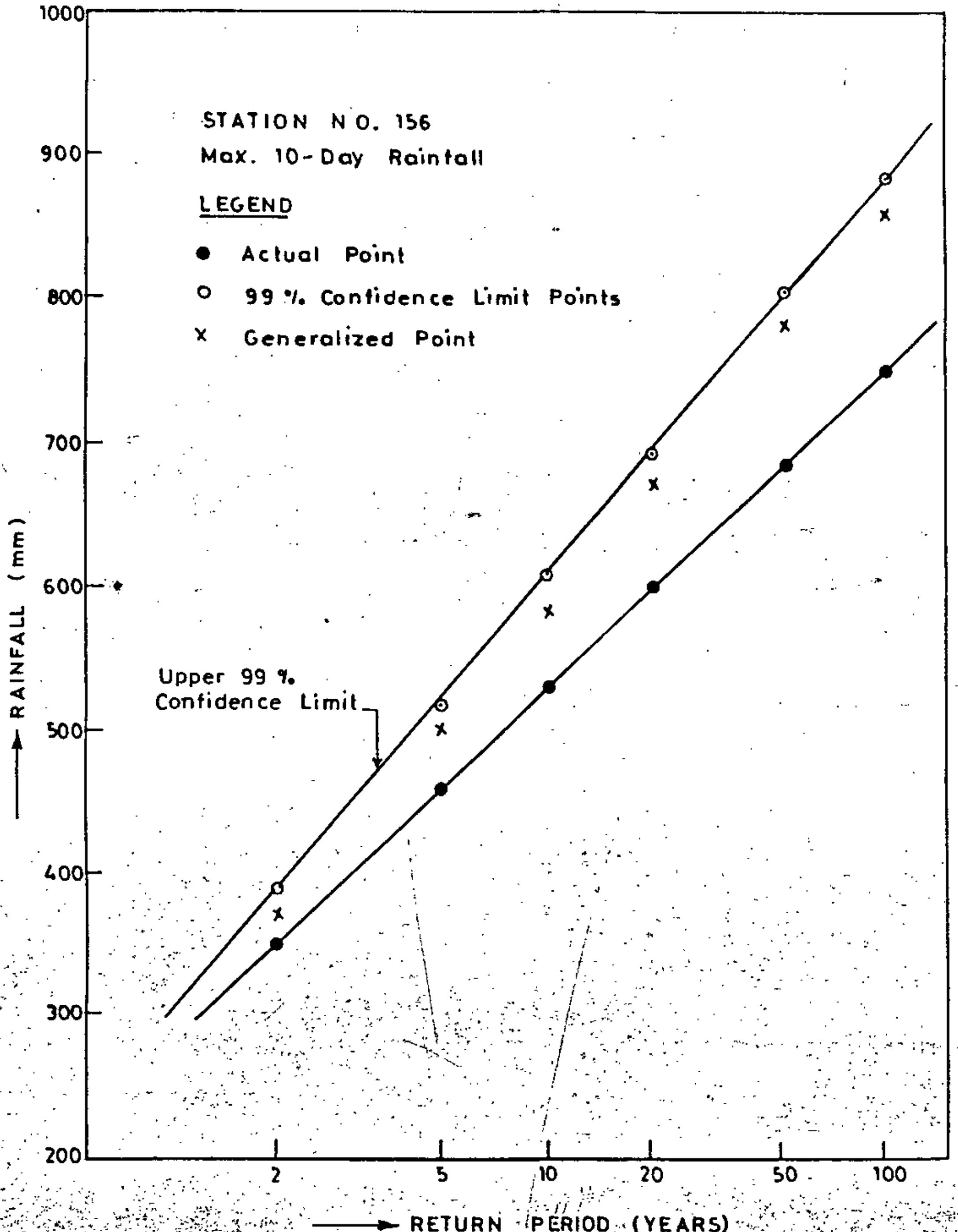
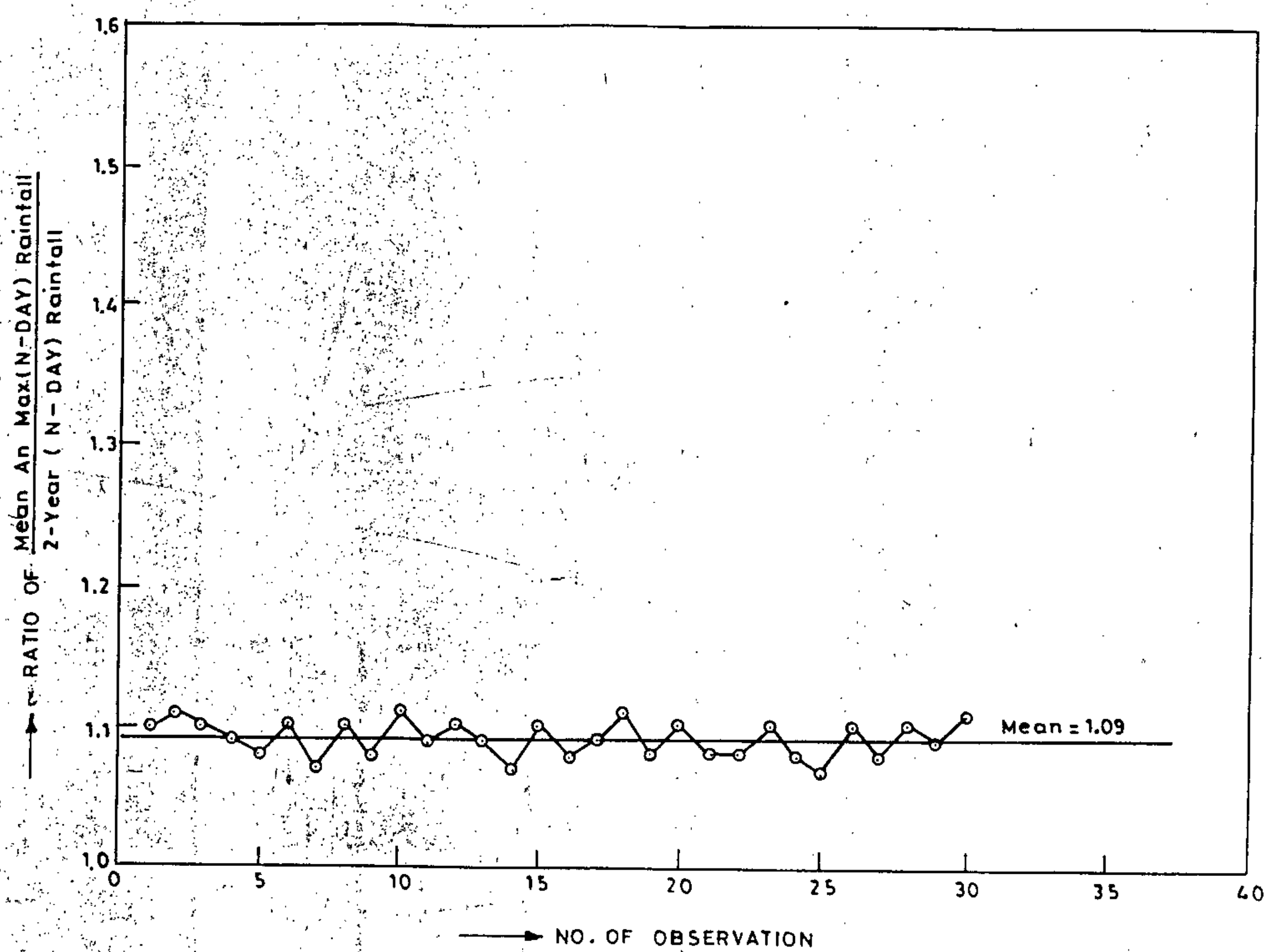


Fig. 61. Typical result of testing.


Mean = 1.09
RATIO OF Mean An Max(N-DAY) Rainfall / 2-Year (N - DAY) Rainfall
NO. OF OBSERVATION
1.0
1.1
1.2
1.3
1.4
1.5
1.6
0
5
10
15
20
25
30
35
40

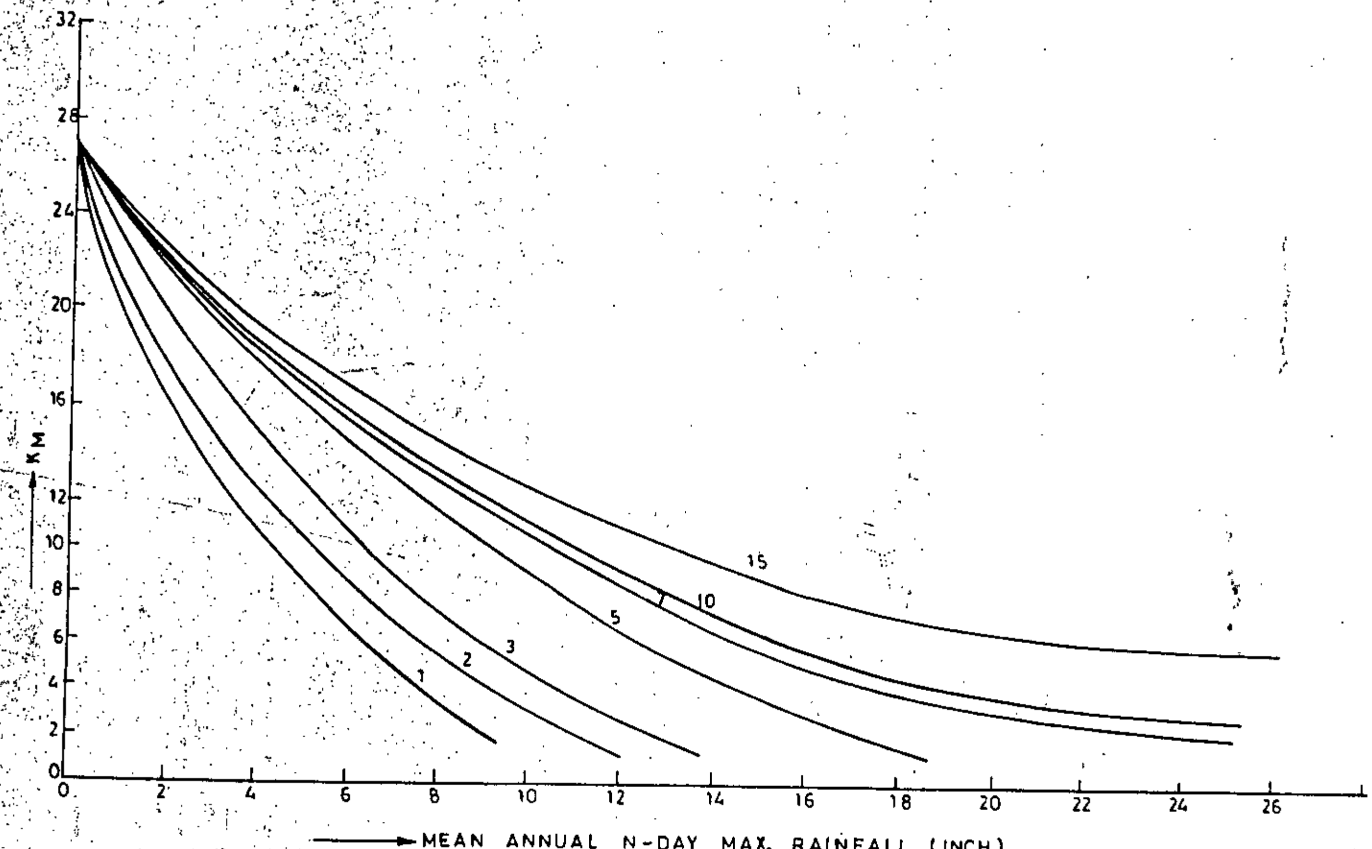


Fig. 63. K_M as a function of Mean Annual N-Day Maximum Rainfall ($N = 1,2,3,5,7,10$ or 15).

APPENDIX - C

```
10 PEN PLOTTER ROUTINE FOR GAMMA DISTRIBUTION
11 OPEN "D",1,"GAMRES",80
12 FOR LG%= 1 TO LOF(1)
13 DIM G(10),X(30),Y(30),RF%(30),FX%(30),TR(200),TF(200),PR%(200),PX%(200)
20 PRINT
30 INPUT " ENTER YOUR STARTING POINT ";GG
50 G(1)=GG
60 II=40
70 FOR J=2 TO 10
80 G(J)=G(J-1)+II
90 NEXT J
100 PRINT " THE RANGE OF RAINFALL IS " G(1) "TO " G(10)
110 A$="PI HA 1700,50 0 D 5,0 U 25,-15 S41"+STR$(G(1))+"_ U 0,0 D 0,140 5,140 U 25,125 S41"+STR$(G(2))+"_ U 0,140 D 0,280 5,280 U 25
,265 S41"+STR$(G(3))+"_ U 0,280 D"
120 GOSUB 60000
130 A$="0,420 5,420 U 25,405 S41"+STR$(G(4))+"_ U 0,420 D 0,560 5,560 U 25,545 S41"+STR$(G(5))+"_ U 0,560 D 0,700 5,700 U 25,685 S41
"+STR$(G(6))+"_ U 0,700 D 0,840 5,840 U 25,825 S41"+STR$(G(7))+"_ U"
140 GOSUB 60000
150 A$="0,840 D 0,980 5,980 U 25,965 S41"+STR$(G(8))+"_ U 0,980 D 0,1120 5,1120 U 25,1105 S41"+STR$(G(9))+"_ U 0,1120 D 0,1260 5,126
0 U 25,1245 S41"+STR$(G(10))+"_ U 60,600 S41 RAINFALL IN MM._ U"
160 GOSUB 60000
165 ERASE G
170 A$="0,0 D 0,-5 U 10,-15 S31 0.0_ U 0,0 D -150,0 -150,-5 U -135,-15 S31 0.1_ U -150,0 D -300,0 -300,-5 U -285,-15 S31 0.2_ U -300
,0 D -450,0 -450,-5 U -435,-15 S31 0.3_ U -450,0 D -600,0 -600,-5 U -585,-15 S31 0.4_ U -600,0 D -750,0 -750,-5 U"
180 GOSUB 60000
190 A$="-735,-15 S31 0.5_ U -750,0 D -900,0 -900,-5 U -885,-15 S31 0.6_ U -900,0 D -1050,0 -1050,-5 U -1035,-15 S31 0.7_ U -1050,0 D
 -1200,0 -1200,-5 U -1185,-15 S31 0.8_ U -1200,0 D -1350,0"
200 GOSUB 60000
210 A$="-1350,-5 U -1335,-15 S31 0.9_ U -1350,0 D -1500,0 -1485,-15 S31 1.0_ U -1500,0 D L6 -1500,1260 U -1200,1260 D L6 -1200,0 U -
900,0 D L6 -900,1260 U -600,1260 D L6 -600,0 U -300,0 D L6 -300,1260 U 0,0":GOSUB 60000
220 FIELD 1,80 AS B$
230 IF LG%>1 GOTO 280
240 INPUT " TYPE IN YOUR RECORD NUMBER ";RN%
250 GET 1,RN%
260 PRINT B$
270 GOTO 300
280 GET 1
290 PRINT B$
300 ST$=LEFT$(B$,9)
310 MDAYS=VAL(MID$(B$,10,2))
320 NDAT=VAL(MID$(B$,12,2))
330 I%=0
340 GET 1
350 FOR J%=1 TO 70 STEP 10
360 I%=I%+1
370 X(I%)=VAL(MID$(B$,J%+1,6))
380 Y(I%)=VAL(MID$(B$,J%+7,4))
390 IF I%=NDAT GOTO 420
400 NEXT J%
410 GOTO 340
420 GET 1
430 PRINT B$
440 ALP$=LEFT$(B$,14)
450 BET$=MID$(B$,15,8)
```

```
460 PRINT ALF$,BET$
470 A$="-500,900 S42 GAMMA DISTRIBUTION_ -450,900 S42 STATION NO."+ST$+"_ U":GOSUB 60000
472 A$="-400,900 S41 MAXIMUM"+STR$(MDAYS)+"-DAY RAINFALL_ U -350,900 S41 ALPHA= "+ALF$+"_ U":GOSUB 60000
473 A$="-300,900 S41 BETA = "+BET$+"_ U"
475 GOSUB 60000
480 FOR IK%=1 TO NDAT
490 RF%(IK%)= (X(IK%)-GG)*3.50
500 FX%(IK%)=-Y(IK%)*1.5
510 A$=STR$(FX%(IK%))+","+STR$(RF%(IK%))+"D M11": GOSUB 60000
520 NEXT IK%
525 A$="0,0":GOSUB 60000
530 ERASE X,Y,RF%,FX%
540 GET 1
550 PRINT B$
560 NTP=VAL(MID$(B$,12,2))
565 PRINT " NO. OF THEORETICAL POINTS", NTP
570 II%=0
580 GET 1
585 PRINT B$
590 FOR K%=1 TO 70 STEP 10
595 II%=II%+1
600 TR(II%)=VAL(MID$(B$,K%+1,6))
610 TF(II%)=VAL(MID$(B$,K%+7,4))
615 PRINT "TR(II%)",TR(II%)
616 PRINT "TF(II%)",TF(II%)
620 IF II%=NTP GOTO 650
630 NEXT K%
640 GOTO 580
650 FOR LL%= 1 TO NTP
660 IF TF(LL%)=0 GOTO 700
670 PR%(LL%)=(TR(LL%)-GG)*3.5
680 PX%(LL%)=(-TF(LL%))*1.5
690 A$="D L6"+STR$(PX%(LL%))+","+STR$(PR%(LL%))+"U":GOSUB 60000
700 NEXT LL%
710 ERASE TR,TF,PR%,PX%
720 STOP
730 NEXT L6%
740 CLOSE 1
750 END
60000 DEFUSR0=&HEFB0
60010 IF A$="" THEN RETURN
60020 A$=";:"+A$
60030 FOR Z=1 TO LEN(A$)
60040 Z1$=MID$(A$,Z,1)
60050 Z1$=USR0(Z1$)
60060 NEXT Z
60070 Z1$=CHR$(32):Z1$=USR0(Z1$)
60080 Z1$=CHR$(13):Z1$=USR0(Z1$)
60090 Z1$=CHR$(10):Z1$=USR0(Z1$)


60100 Z1$=CHR$(0) :Z1$=USR0(Z1$)
60110 IF Z1$=CHR$(13) THEN RETURN
60120 GOTO 60100
```

```
10 REM PLOTTER ROUTINE FOR DOUBLE EXP. DIST. FN.
12 OPEN "D",1,"RESULT1",80
15 FOR LG%=1 TO 77
16 DIM RF%(30),RD%(30),X(50),Y(50),B(10)
20 A$="H P1 A 1750,50 U D 5,0 U 10,-6 S11 -2_ 0,0 D 0,200 5,200 U 10,194 S11 -1_ 0,200 D 0,400 5,400 U 10,374 S11 0_ 0,400 D 0,600 5
,600 U 10,594 S11 1_ 0,600 D 0,800 5,800 U 10,794 S11 2_ 0,800 D 0,1000 5,1000 U10,994 S11 3_ 0,1000 D 0,1000"

30 GOSUB 60000
40 A$="D 0,1200 5,1200 U 10,1174 S11 4_ 40,400 S41 REDUCED VARIATE_ U 60,0 D 65,0 U 85,-40 S41 1.0006_ U 60,0 D 60,200 65,200 U 85,
180 S41 1.07_ U 60,200 D 60,400 65,400 U 85,380 S41 1.58_ U 60,400 D 60,600 65,600 U 85,580 S41 3.29_"
50 GOSUB 60000
60 A$="U 60,600 D 60,800 65,800 U 85,790 S41 7.9_ U 60,800 D 60,1000 65,1000 U 85,980 S41 20.6_ U 60,1000 D 60,1200 65,1200 U 85,119
0 S41 55_ U 110,400 S41 RETURN PERIOD T_ U 0,0"
70 GOSUB 60000
80 PRINT
90 INPUT " TYPE IN YOUR STARTING POINT ";BB
110 B(1)=BB
120 I=40
130 FOR J=2 TO 10
140 B(J)=B(J-1)+I
150 NEXT J
260 A$="D 0,-5 U 15,-15 S31"+STR$(B(1))+"_ U 0,0 D -150,0 -150,-5 U -135,-15 S31"+STR$(B(2))+"_ U -150,0 D -300,0 -300,-5 U -285, 15
 S31"+STR$(B(3))+"_ U"
270 GOSUB 60000
280 A$="-300,0 D 450,0 -450,-5 U -435,-15 S31"+STR$(B(4))+"_ U 450,0 D -600,0 -600,-5 U -585,-15 S31"+STR$(B(5))+"_ U -600,0 D -75
0,0 -750,-5 -735,-15 S31"+STR$(B(6))+"_ U"
285 GOSUB 60000
290 A$="-750,0 D -900,0 -900,-5 U -885,-15 S31"+STR$(B(7))+"_ U -900,0 D -1050,0 -1050,-5 U -1035,-15 S31"+STR$(B(8))+"_ U -1050,0 D
 -1200,0 -1200,-5 U -1185,-15 S31"+STR$(B(9))+"_ U"

295 GOSUB 60000
300 A$="-1200,0 D -1350,0 -1350,-5 U -1335,-15 S31"+STR$(B(10))+"_ U -1430,0 S31 RAINFALL IN MM._ U 0,400 U 0,-94 D L6 -1350,-94 U -
1350,17 D L6 0.17 U 0,134 D L6 -1350,134"
310 GOSUB 60000
320 A$="U -1350,300 D L6 0,300 U 0,0"
325 GOSUB 60000
330 REM OPEN "D",1,"RESULT1",80
335 ERASE B
340 FIELD 1,80 AS AA$
341 IF LG%>1 GOTO 350
342 INPUT "TYPE IN YOUR RECORD NO.";RN%
343 GET 1,RN%
344 PRINT AA$ :GOTO 370
350 GET 1
360 PRINT AA$
370 S$=LEFT$(AA$,9)
380 MDAYS=VAL(MID$(AA$,10,2))
390 NDAT=VAL(MID$(AA$,12,2))
400 I%=0
410 GET 1
420 FOR J%=1 TO 70 STEP 10
430 I%=I%+1
450 X(I%)=VAL(MID$(AA$,J%+1,6))
460 Y(I%)=VAL(MID$(AA$,J%+7,4))
465 IF I%=NDAT GOTO 490
```

```
470 NEXT J%
480 GOTO 410
490 GET 1
495 PRINT AA$
500 BETA=VAL(LEFT$(AA$,14))
510 VU=VAL(MID$(AA$,15,8))
520 PIV1=VAL(MID$(AA$,23,8))
530 FFGK=VAL(MID$(AA$,31,8))
540 PIV2=VAL(MID$(AA$,39,8))
550 PIR2=VAL(MID$(AA$,47,8))
555 PRINT FFGK , PIR2
560 A$="-500,500 S42 STATION NO."+SI$+"_ U -450,500 S41 MAXIMUM"+STR$(MDAYS)+"-DAY RAINFALL_ U -400,500 S41 U="+STR$(VU)+"_ U -350,5
00 S41 BETA="+STR$(BETA)+"_ U"
570 GOSUB 60000
580 FOR IK%=1 TO NDAT
590 RFX(IK%)=(-X(IK%)+BB)*3.75
600 RDX(IK%)=Y(IK%)*2
610 A$=STR$(RFX(IK%))+","+STR$(RDX(IK%))+"D M11" : GOSUB 60000
630 NEXT IK%
640 RNI%=(-FFGK+BB)*3.75
650 ASD%=(-PIR2+BB)*3.75
655 PRINT RNI%, ASD%
660 A$=STR$(RNI%)+",0 DM24 D" :GOSUB 60000
665 A$=STR$(ASD%)+",600 U DM24 U P0 H 900,900"
670 GOSUB 60000
675 ERASE X,Y,RFX,RDX
680 STOP
690 NEXT L6%
700 CLOSE 1
710 END
60000 DEFUSR0=&HEF80
60010 IF A$="" THEN RETURN
60020 A$=";:"+A$
60030 FOR Z=1 TO LEN(A$)
60040 Z1$=MID$(A$,Z,1)
60050 Z1$=USR0(Z1$)
60060 NEXT Z
60070 Z1$=CHR$(32):Z1$=USR0(Z1$)
60080 Z1$=CHR$(13):Z1$=USR0(Z1$)
60090 Z1$=CHR$(10):Z1$=USR0(Z1$)
60100 Z1$=CHR$(0) :Z1$=USR0(Z1$)
60110 IF Z1$=CHR$(13) THEN RETURN
60120 GOTO 60100
```

```
@LOAD FFORTRAN
COPTION LIST,RESET,LOG
C        DOUBLE EXPONENTIAL DISTRIBUTION FUNCTION(T)
         DIMENSION NYR(30),A(30),A1(30),A2(30),A3(30),A4(30),A5(30),
        *A6(30),A7(30),LB(30),RP(30),SIGMA(30),YBAR(30),LD(10),RV(30)
         DATA LD/1,2,3,5,7,10,15/
         READ(1,1)(SIGMA(I1),YBAR(I1),I1=15,25)
1        FORMAT(2F10.6)
99       READ(1,2,END=9)STN,N
2        FORMAT(2I3)
         WRITE(3,2)STN,N
         DO 333 I2=1,N
         READ(1,3)(NYR(I2),A1(I2),A2(I2),A3(I2),A4(I2),A5(I2),A6(I2),
        *A7(I2))
         WRITE(3,3)(NYR(I2),A1(I2),A2(I2),A3(I2),A4(I2),A5(I2),A6(I2),
        *A7(I2))
333      CONTINUE
3        FORMAT(2X,I4,7(4X,F6.1))
         DO 111 I3=1,7
         DO 109 IL=1,30
109      LB(IL)=IL
         GO TO (100,200,300,400,500,600,700),I3
100      DO 101 J1=1,N
101      A(J1)=A1(J1)
         WRITE(3,31)STN
31       FORMAT(1H1,5X,'STATION NO.=',2X,I3,/)
         WRITE(3,32)LD(I3)
32       FORMAT(5X,'MAXIMUM',I5,'-DAY RAINFALL',/)
         GO TO 1000
200      DO 201 J2=1,N
201      A(J2)=A2(J2)
         WRITE(3,31)STN
         WRITE(3,32)LD(I3)
         GO TO 1000
300      DO 301 J3=1,N
301      A(J3)=A3(J3)
         WRITE(3,31)STN
         WRITE(3,32)LD(I3)
         GO TO 1000
400      DO 401 J4=1,N
401      A(J4)=A4(J4)
         WRITE(3,31)STN
         WRITE(3,32)LD(I3)
         GO TO 1000
500      DO 501 J5=1,N
501      A(J5)=A5(J5)
         WRITE(3,31)STN
         WRITE(3,32)LD(I3)
         GO TO 1000
600      DO 601 J6=1,N
601      A(J6)=A6(J6)
         WRITE(3,31)STN
         WRITE(3,32)LD(I3)
         GO TO 1000
700      DO 701 J7=1,N
701      A(J7)=A7(J7)
         WRITE(3,31)STN
         WRITE(3,32)LD(I3)
C        SORT IN ORDER
1000     DO 77 J=1,N
         K=J
150      X=A(J)
         JYR=NYR(J)
         K=K+1
         IF(K.GT.N)GO TO 77
         Y=A(K)
         KYR=NYR(K)
         IF(X.GE.Y)GO TO 150
         A(K)=X
         NYR(K)=JYR
         A(J)=Y
         NYR(J)=KYR
         GO TO 150
77       CONTINUE
         DO 11 NN=1,N
         M=NN
210      LN=LB(NN)
```

```
      XX=A(NN)
      NY=NYR(NN)
      M=M+1
      IF(M.GT.N)GO TO 11
      YY=A(M)
      LM=LB(M)
      MY=NYR(M)
      IF(NY.LT.MY)GO TO 210
      A(M)=XX
      NYR(M)=NY
      LB(M)=LN
      A(NN)=YY
      NYR(NN)=MY
      LB(NN)=LM
      GO TO 210
11    CONTINUE
      WRITE(3,33)
33    FORMAT(5X,'YEAR',7X,'RAINFALL',7X,'ORDER',7X,'RETURN'
     *2X,'PERIOD',7X,'RED VAR',/)
      DO 22 KJ=1,N
      RP(KJ)=FLOAT(N+1)/FLOAT(LB(KJ))
      C1=RP(KJ)/(RP(KJ)-1.0)
      C2=ALOG(C1)
      C3=1.0/C2
      RV(KJ)=ALOG(C3)
      WRITE(3,34)NYR(KJ),A(KJ),LB(KJ),RP(KJ),RV(KJ)
34    FORMAT(5X,I4,5X,F8.2,7X,I5,12X,F8.2,9X,F8.2)
22    CONTINUE
      SUM=0.0
      DO 55 KK=1,N
      SUM=SUM+A(KK)
55    CONTINUE
      XMEAN=SUM/FLOAT(N)
      SSUM=0.0
      DO 44 KM=1,N
      SSUM=SSUM+(A(KM)-XMEAN)**2
44    CONTINUE
      STD=SQRT(SSUM/N)
      VBETA=STD/SIGMA(N)
      VU=XMEAN-YBAR(N)*VBETA
      WRITE(3,35)VBETA,VU
35    FORMAT(/,9X,'VALUE OF BETA=',F10.4/9X,'VALUE OF U=',F10.4,/)
      WRITE (3,36)STD,XMEAN
36    FORMAT(/,10X,'STANDARD DEVIATION =',F10.4,/,10X,'MEAN ='F8.3,/)
111   CONTINUE
      GO TO 99
9     STOP
      END


C     GAMMA DISTRIBUTION (G)
      DIMENSION NYR(30),A(30),A1(30),A2(30),A3(30),A4(30),A5(30),
     *A6(30),A7(30),LB(30),RP(30),LD(10),VX(100),GX(500),
     *FFXP(1000),FX(2000),FFX(1000)
      DATA LD/1,2,3,5,7,10,15/
      READ(1,1)(GX(I1),I1=100,200)
1     FORMAT(3X,F8.5)
C     WRITE(3,1)(GX(I35),I35=100,200)
99    READ(1,2,END=9)STN,N
2     FORMAT(2I3)
      DO 333 I2=1,N
      READ(1,3)(NYR(I2),A1(I2),A2(I2),A3(I2),A4(I2),A5(I2),A6(I2),
     *A7(I2))
333   CONTINUE
3     FORMAT(2X,I4,7(4X,F6.1))
      DO 111 I3=1,7
      DO 109 IL=1,30
109   LB(IL)=IL
      GO TO (100,200,300,400,500,600,700),I3
100   DO 101 J1=1,N
101   A(J1)=A1(J1)
      WRITE(3,31)STN
31    FORMAT(1H1,5X,'STATION NO.=',2X,I3,/)
      WRITE(3,32)LD(I3)
32    FORMAT(5X,'MAXIMUM',I5,'-DAY RAINFALL',/)
      GO TO 1000
200   DO 201 J2=1,N
```

```
201     A(J2)=A2(J2)
        WRITE(3,31)STN
        WRITE(3,32)LD(I3)
        GO TO 1000
300     DO 301 J3=1,N
301     A(J3)=A3(J3)
        WRITE(3,31)STN
        WRITE(3,32)LD(I3)
        GO TO 1000
400     DO 401 J4=1,N
401     A(J4)=A4(J4)
        WRITE(3,31)STN
        WRITE(3,32)LD(I3)
        GO TO 1000
500     DO 501 J5=1,N
501     A(J5)=A5(J5)
        WRITE(3,31)STN
        WRITE(3,32)LD(I3)
        GO TO 1000
600     DO 601 J6=1,N
601     A(J6)=A6(J6)
        WRITE(3,31)STN
        WRITE(3,32)LD(I3)
        GO TO 1000
700     DO 701 J7=1,N
701     A(J7)=A7(J7)
        WRITE(3,31)STN
        WRITE(3,32)LD(I3)
C       SORT IN ORDER
1000    DO 77 J=1,N
        K=J
150     X=A(J)
        JYR=NYR(J)
        K=K+1
        IF(K.GT.N)GO TO 77
        Y=A(K)
        KYR=NYR(K)
        IF(X.GE.Y)GO TO 150
        A(K)=X
        NYR(K)=JYR
        A(J)=Y
        NYR(J)=KYR
        GO TO 150
77      CONTINUE
        DO 11 NN=1,N
        M=NN
210     LN=LB(NN)
        XX=A(NN)
        NY=NYR(NN)
        M=M+1
        IF(M.GT.N)GO TO 11
        YY=A(M)
        LM=LB(M)
        MY=NYR(M)
        IF(NY.LT.MY)GO TO 210
        A(M)=XX
        NYR(M)=NY
        LB(M)=LN
        A(NN)=YY
        NYR(NN)=MY
        LB(NN)=LM
        GO TO 210
11      CONTINUE
        WRITE(3,33)
33      FORMAT(5X,'YEAR',7X,'RAINFALL',7X,'ORDER',7X,'FF(X)',/)
        DO 22 KJ=1,N
        RP(KJ)=FLOAT(N+1)/FLOAT(LB(KJ))
        FFXP(KJ)=1.0-1.0/RP(KJ)
        WRITE(3,34)NYR(KJ),A(KJ),LB(KJ),FFXP(KJ)
34      FORMAT(4X,I4,7X,F8.2,7X,I5,5X,F8.2)
22      CONTINUE
        SUM=0.0
        DO 55 KK=1,N
        SUM=SUM+A(KK)
55      CONTINUE
        XMEAN=SUM/FLOAT(N)
        SUMSQ=0.0
        DO 44 KA=1,N
        SUMSQ=SUMSQ+(A(KA)-XMEAN)**2
44      CONTINUE
        STD=SQRT(SUMSQ/FLOAT(N))
```

```
      ALPH=(XMEAN/STD)**2
      BETA=(STD**2)/XMEAN
      GALPH=1.00
      KM=INT(ALPH-1.0)
      DO 66 KN=1,KM
      AALPH=ALPH-FLOAT(KN)
      GALPH=GALPH*AALPH
66    CONTINUE
      AALPH=AALPH*100.0
      NALPH=INT(AALPH)
      GALPH=GALPH*GX(NALPH)
      XNUM=(BETA**ALPH)*GALPH
      WRITE(3,35)XMEAN,STD,ALPH,BETA,XNUM,GX(NALPH)
35    FORMAT(///,2X,'XMEAN=',F10.5,/,2X,'STD=',F10.5,/,2X,'ALPH='F8.2,
     */,2X,'BETA=',F10.5,/,2X,'XNUM=',E15.6,/,2X,'GX(NALPH)='F15.9)
      MN=1
      AN=0.0
C
      WRITE (3,38)
38    FORMAT(//,20X,'TABLE OF X AND F(X)',///,17X,'X',15X,'FUNCTION',
     *2X,'FX(PDF)',/,15X,30('-'),//)
214   FX(MN)=(EXP(-AN/BETA)*AN**(ALPH-1.0))/XNUM
      IF(FX(MN).LE..0001)FX(MN)=0.0
C
      WRITE(3,39)AN,FX(MN)
39    FORMAT(10X,F8.2,20X,F12.5)
      AN=AN+1.00
      MN=MN+1
      IF(AN.LE.500.0)GO TO 214
      NNN=10
      WRITE(3,49)
49    FORMAT(/,15X,'TABLE OF X AND F(X)(CDF)',/,13X,30('-'),//)
      DO 88 IK=11,500,10
      SUM=0.0
      SUMODD=0.0
      SUMEVN=0.0
      DO 99 IN=1,IK
      IF(IN.EQ.1.OR.IN.EQ.IK)GO TO 98
      IINI=IN/2
      IIN=IINI*2
      IF(IIN.EQ.IN)GO TO 93
      SUMEVN=SUMEVN+FX(IN)*2.0
      GO TO 99
93    SUMODD=SUMODD+FX(IN)*4.0
      GO TO 99
98    SUM=SUM+FX(IN)
99    CONTINUE
C
      WRITE(3,51)SUM,SUMEVN,SUMODD
51    FORMAT(/,5X,3E15.5)
      FFX(IK)=(SUM+SUMODD+SUMEVN)*(1.00/3.0)
      WRITE(3,40)NNN,FFX(IK)
40    FORMAT(10X,I5,5X,F10.4)
      NNN=NNN+10
88    CONTINUE
111   CONTINUE
      GO TO 94
9     STOP
      END
```

```
C     KOLMOGOROV-SMIRNOV TEST OF GUMBEL DISTRIBUTION
      DIMENSION NYR(30),A(30),A1(30),A2(30),A3(30),A4(30),A5(30),
     *A6(30),A7(30),LB(30),RP(30),SIGMA(30),YBAR(30),LD(10),RV(30),
     *DEL(30),XKS(30),URI(50)
      DATA LD/1,2,3,5,7,10,15/
      READ(1,1)(SIGMA(II),YBAR(II),II=15,25)
1     FORMAT(2F10.6)
      WRITE(3,33)
33    FORMAT(80('_'),/,25X,'CRITICAL VALUE CHART',/,80('_'))
      WRITE(3,31)
31    FORMAT(25X,'MAXIMUM DAY RAINFALL',/,80('_'),//,1X,'STN. NO.',5X,
     *'(1)',7X,'(2)',7X,'(3)',7X,'(5)',7X,'(7)',6X,'(10)',6X,'(15)',/,
     *80('_'))
99    READ(1,2,END=9)STN,N
2     FORMAT(2I3)
      URI(15)=0.34
      URI(16)=0.33
      URI(17)=0.32
      URI(18)=0.31
```

```
      URI(19)=0.30
      URI(20)=0.29
      URI(21)=0.285
      URI(22)=0.282
      URI(23)=0.279
      URI(24)=0.274
      URI(25)=0.270
      DO 333 I2=1,N
      READ(1,3)(NYR(I2),A1(I2),A2(I2),A3(I2),A4(I2),A5(I2),A6(I2),
     *A7(I2))
  333 CONTINUE
    3 FORMAT(2X,I4,7(4X,F6.1))
      DO 111 I3=1,7
      DO 109 IL=1,30
  109 LB(IL)=IL
      GO TO (100,200,300,400,500,600,700),I3
  100 DO 101 J1=1,N
  101 A(J1)=A1(J1)
      GO TO 1000
  200 DO 201 J2=1,N
  201 A(J2)=A2(J2)
      GO TO 1000
  300 DO 301 J3=1,N
  301 A(J3)=A3(J3)
      GO TO 1000
  400 DO 401 J4=1,N
  401 A(J4)=A4(J4)
      GO TO 1000
  500 DO 501 J5=1,N
  501 A(J5)=A5(J5)
      GO TO 1000
  600 DO 501 J6=1,N
  601 A(J5)=A5(J6)
      GO TO 1000
  700 DO 701 J7=1,N
  701 A(J7)=A7(J7)
C     SORT IN ORDER
 1000 DO 77 J=1,N
      K=J
  150 X=A(J)
      JYR=NYR(J)
      K=K+1
      IF(K.GT.N)GO TO 77
      Y=A(K)
      KYR=NYR(K)
      IF(X.GE.Y)GO TO 150
      A(K)=X
      NYR(K)=JYR
      A(J)=Y
      NYR(J)=KYR
      GO TO 150
   77 CONTINUE
      DO 11 NN=1,N
      M=NN
  210 LN=LB(NN)
      XX=A(NN)
      NY=NYR(NN)
      M=M+1
      IF(M.GT.N)GO TO 11
      YY=A(M)
      LM=LB(M)
      MY=NYR(M)
      IF(NY.LT.MY)GO TO 210
      A(M)=XX
      NYR(M)=NY
      LB(M)=LN
      A(NN)=YY
      NYR(NN)=MY
      LB(NN)=LM
      GO TO 210
   11 CONTINUE
      SUM=0.0
      DO 55 KK=1,N
      SUM=SUM+A(KK)
   55 CONTINUE
      XMEAN=SUM/FLOAT(N)
      SSUM=0.0
      DO 44 KM=1,N
      SSUM=SSUM+(A(KM)-XMEAN)**2
   44 CONTINUE
      STD=SQRT(SSUM/N)
```

```
      VBETA=SIG/SIGMA(N)
      VU=XMEAN-YBAR(N)*VBETA
      DO 22 KJ=1,N
      RP(KJ)=FLOAT(N+1)/FLOAT(LB(KJ))
      UU=(VU-A(KJ))/VBETA
      G=EXP(EXP(UU))
      RG=G/(G-1.0)
      RGT=(RG-1.0)/RG
      RPT=(RP(KJ)-1.0)/RP(KJ)
      DEL(KJ)=ABS(RGT-RPT)
 22   CONTINUE
      GO=DEL(1)
      DO 129 NJ=2,N
      IF(DEL(NJ).GE.GO)GO=DEL(NJ)
 129  CONTINUE
      XKS(I3)=URI(N)-GO
 111  CONTINUE
      WRITE(3,5)STN,(XKS(II),II=1,7)
 5    FORMAT(2X,I3,3X,7F10.4)
      GO TO 99
 9    STOP
      END


C     KOLMOGOROV-SMIRNOV TEST OF GAMMA DISTRIBUTION
      DIMENSION NYR(30),A(30),A1(30),A2(30),A3(30),A4(30),A5(30),
     *A6(30),A7(30),LB(30),RP(30),LD(10),VX(100),GX(500),URI(30),
     *FFXP(1000),FX(2000),FFX(1000),AC(1000),DEL(30),XKS(500)
      DATA LD/1,2,3,5,7,10,15/
      READ(1,1)(GX(II),II=100,200)
 1    FORMAT(3X,F8.5)
      URI(15)=0.34
      URI(16)=0.33
      URI(17)=0.32
      URI(18)=0.31
      URI(19)=0.30
      URI(20)=0.29
      URI(21)=0.285
      URI(22)=0.282
      URI(23)=0.278
      URI(24)=0.274
      URI(25)=0.270
      WRITE(3,33)
 33   FORMAT(80('_'),/,25X,'CRITICAL VALUE CHART ',/,80('_'))
      WRITE(3,31)
 31   FORMAT(25X,'MAXIMUM DAY RAINFALL',/,80('_'),//,1X,'STN. NO.',5X,
     *'(1)',7X,'(2)',7X,'(3)',7X,'(5)',7X,'(7)',6X,'(10)',6X,'(15)',/,
     *80('_'))
 99   READ(1,2,END=9)STN,N
 2    FORMAT(2I3)
      DO 333 I2=1,N
      READ(1,3)(NYR(I2),A1(I2),A2(I2),A3(I2),A4(I2),A5(I2),A6(I2),
     *A7(I2))
 3    FORMAT(2X,I4,7(4X,F6.1))
 333  CONTINUE
      DO 111 I3=1,7
      DO 109 IL=1,30
 109  LB(IL)=IL
      GO TO (100,200,300,400,500,600,700),I3
 100  DO 101 J1=1,N
 101  A(J1)=A1(J1)
      GO TO 1000
 200  DO 201 J2=1,N
 201  A(J2)=A2(J2)
      GO TO 1000
 300  DO 301 J3=1,N
 301  A(J3)=A3(J3)
      GO TO 1000
 400  DO 401 J4=1,N
 401  A(J4)=A4(J4)
      GO TO 1000
 500  DO 501 J5=1,N
 501  A(J5)=A5(J5)
      GO TO 1000
 600  DO 601 J6=1,N
```

```
601   A(J6)=AS(J6)
      GO TO 1000
700   DO 701 J7=1,N
701   A(J7)=A7(J7)
C     SORT IN ORDER
1000  DO 77 J=1,N
      K=J
150   X=A(J)
      JYR=NYR(J)
      K=K+1
      IF(K.GT.N)GO TO 77
      Y=A(K)
      KYR=NYR(K)
      IF(X.GE.Y)GO TO 150
      A(K)=X
      NYR(K)=JYR
      A(J)=Y
      NYR(J)=KYR
      GO TO 150
77    CONTINUE
      DO 11 NN=1,N
      M=NN
210   LN=LB(NN)
      XX=A(NN)
      NY=NYR(NN)
      M=M+1
      IF(M.GT.N)GO TO 11
      YY=A(M)
      LM=LB(M)
      MY=NYR(M)
      IF(NY.LT.MY)GO TO 210
      A(M)=XX
      NYR(M)=NY
      LB(M)=LN
      A(NN)=YY
      NYR(NN)=MY
      LB(NN)=LM
      GO TO 210
11    CONTINUE
      DO 22 KJ=1,N
      RP(KJ)=FLOAT(N+1)/FLOAT(LB(KJ))
      FEXP(KJ)=1.0-1.0/RP(KJ)
22    CONTINUE
      SUM=0.0
      DO 55 KK=1,N
      SUM=SUM+A(KK)
55    CONTINUE
      XMEAN=SUM/FLOAT(N)
      SUMSQ=0.0
      DO 44 KA=1,N
      SUMSQ=SUMSQ+(A(KA)-XMEAN)**2
44    CONTINUE
      STD=SQRT(SUMSQ/FLOAT(N))
      ALPH=(XMEAN/STD)**2
      BETA=(STD**2)/XMEAN
      GALPH=1.00
      KM=INT(ALPH-1.0)
      DO 66 KN=1,KM
      AALPH=ALPH-FLOAT(KN)
      GALPH=GALPH*AALPH
66    CONTINUE
      AALPH=AALPH*100.0
      NALPH=INT(AALPH)
      GALPH=GALPH*GX(NALPH)
      XNUM=(BETA**ALPH)*GALPH
      MN=1
      AN=0.0
214   FX(MN)=(EXP(-AN/BETA)*AN**(ALPH-1.0))/XNUM
      IF(FX(MN).LE..0001)FX(MN)=0.0
      AN=AN+1.00
      MN=MN+1
      IF(AN.LE.500.0)GO TO 214
      NNN=10
      DO 88 IK=11,500,10
      SUM=0.0
      SUMODD=0.0
      SUMEVN=0.0
      DO 99 IN=1,IK
      IF(IN.EQ.1.OR.IN.EQ.IK)GO TO 29
      IINI=IN/2
      IIN=IINI*2
```

```
      IF(IIN.EQ.IN)GO TO 98
      SUMEVN=SUMEVN+FX(IN)*2.0
      GO TO 99
93    SUMODD=SUMODD+FX(IN)*4.0
      GO TO 99
98    SUM=SUM+FX(IN)
99    CONTINUE
      FFX(IK)=(SUM+SUMODD+SUMEVN)*(1.00/3.0)
      AC(NNN)=FFX(IK)
      NNN=NNN+10
88    CONTINUE
      DO 12 II=1,N
      DO 13 II=10,1000,10
      AJ=A(II)-FLOAT(II)
      IF(AJ.LE.10.00)GO TO 14
13    CONTINUE
14    IXA=INT(A(II)-AJ)
      IXB=IXA+10
      DIF=((AC(IXB)-AC(IXA))/10.0)*AJ
      RIV=DIF+AC(IXA)
      DEL(II)=ABS(FFXP(II)-RIV)
12    CONTINUE
      GO=DEL(1)
      DO 129 NJ=2,N
      IF(DEL(NJ).GE.GO)GO=DEL(NJ)
129   CONTINUE
      XKS(I3)=JRI(M)-GO
111   CONTINUE
      WRITE(3,15)STN,(XKS(IY),IY=1,7)
15    FORMAT(2X,I3,3X,7F10.4)
      GO TO 94
9     STOP
      END
```

```
C     CHI-SQUARE TEST OF GAMMA DISTRIBUTION
      DIMENSION NYR(30),A(30),A1(30),A2(30),A3(30),A4(30),A5(30),
     +A6(30),A7(30),LB(30),RP(30),LD(10),VX(100),GX(500),
     +FFXP(1000),FX(2000),FFX(1000),XCHD(7)
      DATA LD/1,2,3,5,7,10,15/
      READ(1,1)(GX(II),II=100,200)
1     FORMAT(3X,F8.5)
94    READ(1,2,END=9)STN,N
2     FORMAT(2I3)
      DO 333 I2=1,N
      READ(1,3)(NYR(I2),A1(I2),A2(I2),A3(I2),A4(I2),A5(I2),A6(I2),
     +A7(I2))
333   CONTINUE
3     FORMAT(2X,I4,7(4X,F6.1))
      DO 111 I3=1,7
      DO 109 IL=1,30
109   LB(IL)=IL
      GO TO (100,200,300,400,500,600,700),I3
100   DO 101 J1=1,N
101   A(J1)=A1(J1)
      GO TO 1000
200   DO 201 J2=1,N
201   A(J2)=A2(J2)
      GO TO 1000
300   DO 301 J3=1,N
301   A(J3)=A3(J3)
      GO TO 1000
400   DO 401 J4=1,N
401   A(J4)=A4(J4)
      GO TO 1000
500   DO 501 J5=1,N
501   A(J5)=A5(J5)
      GO TO 1000
600   DO 601 J6=1,N
601   A(J6)=A6(J6)
      GO TO 1000
700   DO 701 J7=1,N
701   A(J7)=A7(J7)
C     SORT IN ORDER
1000  DO 77 J=1,N
      K=J
150   X=A(J)
```

```
      JYR=NYR(J)
      K=K+1
      IF(K.GT.N)GO TO 77
      Y=A(K)
      KYR=NYR(K)
      IF(X.GE.Y)GO TO 150
      A(K)=X
      NYR(K)=JYR
      A(J)=Y
      NYR(J)=KYR
      GO TO 150
   77 CONTINUE
      DO 11 NN=1,N
      M=NN
  210 LN=LD(NN)
      XX=A(NN)
      NY=NYR(NN)
      M=M+1
      IF(M.GT.N)GO TO 11
      YY=A(M)
      LM=LD(M)
      MY=NYR(M)
      IF(NY.LT.MY)GO TO 210
      A(M)=XX
      NYR(M)=NY
      LD(M)=LN
      A(NN)=YY
      NYR(NN)=MY
      LD(NN)=LM
      GO TO 210
   11 CONTINUE
      DO 22 KJ=1,N
      RP(KJ)=FLOAT(N+1)/FLOAT(LD(KJ))
      FEXP(KJ)=1.0-1.0/RP(KJ)
   22 CONTINUE
      SUM=0.0
      DO 55 KK=1,N
      SUM=SUM+A(KK)
   55 CONTINUE
      XMEAN=SUM/FLOAT(N)
      SUMSQ=0.0
      DO 44 KA=1,N
      SUMSQ=SUMSQ+(A(KA)-XMEAN)**2
   44 CONTINUE
      STD=SQRT(SUMSQ/FLOAT(N))
      ALPH=(XMEAN/STD)**2
      BETA=(STD**2)/XMEAN
      GALPH=1.00
      KM=INT(ALPH-1.0)
      DO 66 KN=1,KM
      AALPH=ALPH-FLOAT(KN)
      GALPH=GALPH*AALPH
   66 CONTINUE
      AALPH=AALPH*100.0
      NALPH=INT(AALPH)
      GALPH=GALPH*GX(NALPH)
      XNUM=(BETA**ALPH)*GALPH
      MN=1
      AN=0.0
  214 FX(MN)=(EXP(-AN/BETA)*AN**(ALPH-1.0))/XNUM
      IF(FX(MN).LE..0001)FX(MN)=0.0
      AN=AN+1.00
      MN=MN+1
      IF(AN.LE.500.0)GO TO 214
      NNN=10
      DO 98 IK=11,500,10
      SUM=0.0
      SUMODD=0.0
      SUMEVN=0.0
      DO 99 IN=1,IK
      IF(IN.EQ.1.OR.IN.EQ.IK)GO TO 98
      IINI=IN/2
      IIN=IINI*2
      IF(IIN.EQ.IN)GO TO 93
      SUMEVN=SUMEVN+FX(IN)*2.0
      GO TO 99
   93 SUMODD=SUMODD+FX(IN)*4.0
      GO TO 99
   98 SUM=SUM+FX(IN)
   99 CONTINUE
      FFX(IK)=(SUM+SUMODD+SUMEVN)*(1.00/3.0)
```

```
      NNN=NNN+10
88    CONTINUE
      COUNT1=0.0
      COUNT2=0.0
      COUNT3=0.0
      COUNT4=0.0
      COUNT5=0.0
      DO 211 KJ=1,N
      IF(FEXP(KJ).LE.0.2)GO TO 121
      IF(FFXP(KJ).GE.0.2.AND.FFXP(KJ).LE.0.4)GO TO 122
      IF(FFXP(KJ).GE.0.4.AND.FFXP(KJ).LE.0.6)GO TO 123
      IF(FFXP(KJ).GE.0.6.AND.FFXP(KJ).LE.0.8)GO TO 124
      IF(FFXP(KJ).GE.0.8)GO TO 125
121   COUNT1=COUNT1+1.0
      GO TO 211
122   COUNT2=COUNT2+1.0
      GO TO 211
123   COUNT3=COUNT3+1.0
      GO TO 211
124   COUNT4=COUNT4+1.0
      GO TO 211
125   COUNT5=COUNT5+1.0
211   CONTINUE
      CCP=FLOAT(N)*0.2
      CH1=((COUNT1-CCP)**2)/CCP
      CH2=((COUNT2-CCP)**2)/CCP
      CH3=((COUNT3-CCP)**2)/CCP
      CH4=((COUNT4-CCP)**2)/CCP
      CH5=((COUNT5-CCP)**2)/CCP
      CHISQ=CH1+CH2+CH3+CH4+CH5
      XCHQ(I3)=CHISQ
111   CONTINUE
      WRITE(3,12)STN,(XCHQ(IY),IY=1,7)
12    FORMAT(4X,I3,4X,7F8.3)
      GO TO 99
9     STOP
      END


C     CHI-SQUARE TEST OF GUMBEL DISTRIBUTION
      DIMENSION NYR(30),A(30),A1(30),A2(30),A3(30),A4(30),A5(30),
     +A6(30),A7(30),LB(30),RP(30),SIGMA(30),YBAR(30),LD(10),RV(30),
     +XCHQ(7)
      DATA LD/1,2,3,5,7,10,15/
      READ(1,1)(SIGMA(I1),YBAR(I1),I1=15,25)
1     FORMAT(2F10.6)
      WRITE(3,31)
31    FORMAT(80('_'),25X,'VALUE OF CHI-SQUARE',/,80(' '),/,2X,
     +'STN. NO.',5X,'(1)',5X,'(2)',5X,'(3)',5X,'(5)',5X,'(7)',4X,
     +'(10)',4X,'(15)',/,80('_'))
99    READ(1,2,END=9)STN,N
2     FORMAT(2I3)
      DO 333 I2=1,N
      READ(1,3)(NYR(I2),A1(I2),A2(I2),A3(I2),A4(I2),A5(I2),A6(I2),
     +A7(I2))
333   CONTINUE
3     FORMAT(2X,I4,7(4X,F6.1))
      DO 111 I3=1,7
      DO 109 IL=1,30
109   LB(IL)=IL
      GO TO (100,200,300,400,500,600,700),I3
100   DO 101 J1=1,N
101   A(J1)=A1(J1)
      GO TO 1000
200   DO 201 J2=1,N
201   A(J2)=A2(J2)
      GO TO 1000
300   DO 301 J3=1,N
301   A(J3)=A3(J3)
      GO TO 1000
400   DO 401 J4=1,N
401   A(J4)=A4(J4)
      GO TO 1000
500   DO 501 J5=1,N
501   A(J5)=A5(J5)
      GO TO 1000
600   DO 601 J6=1,N
```

```
601       A(J6)=A6(J6)
          GO TO 1000
700       DO 701 J7=1,N
701       A(J7)=A7(J7)
C         SORT IN ORDER
1000      DO 77 J=1,N
          K=J
150       X=A(J)
          JYR=NYR(J)
          K=K+1
          IF(K.GT.N)GO TO 77
          Y=A(K)
          KYR=NYR(K)
          IF(X.GE.Y)GO TO 150
          A(K)=X
          NYR(K)=JYR
          A(J)=Y
          NYR(J)=KYR
          GO TO 150
77        CONTINUE
          DO 11 NN=1,N
          M=NN
210       LN=LB(NN)
          XX=A(NN)
          NY=NYR(NN)
          M=M+1
          IF(M.GT.N)GO TO 11
          YY=A(M)
          LM=LB(M)
          MY=NYR(M)
          IF(NY.LT.MY)GO TO 210
          A(M)=XX
          NYR(M)=NY
          LB(M)=LN
          A(NN)=YY
          NYR(NN)=MY
          LB(NN)=LM
          GO TO 210
11        CONTINUE
          DO 22 KJ=1,N
          RP(KJ)=FLOAT(N+1)/FLOAT(LB(KJ))
          C1=RP(KJ)/(RP(KJ)-1.0)
          C2=ALOG(C1)
          C3=1.0/C2
          RV(KJ)=ALOG(C3)
22        CONTINUE
          SUM=0.0
          DO 55 KK=1,N
          SUM=SUM+A(KK)
55        CONTINUE
          XMEAN=SUM/FLOAT(N)
          SSUM=0.0
          DO 44 KM=1,N
          SSUM=SSUM+(A(KM)-XMEAN)**2
44        CONTINUE
          STD=SQRT(SSUM/N)
          VBETA=STD/SIGMA(N)
          VU=XMEAN-YBAR(N)*VBETA
          COUNT1=0.0
          COUNT2=0.0
          COUNT3=0.0
          COUNT4=0.0
          COUNT5=0.0
          DO 211 KO=1,N
          IF(RV(KO).LE.-0.47)GO TO 121
          IF(RV(KO).GE.-0.47.AND.RV(KO).LE.0.087)GO TO 122
          IF(RV(KO).GE.0.087.AND.RV(KO).LE.0.67)GO TO 123
          IF(RV(KO).GE.0.67.AND.RV(KO).LE.1.5)GO TO 124
          IF(RV(KO).GE.1.5)GO TO 125
121       COUNT1=COUNT1+1.0
          GO TO 211
122       COUNT2=COUNT2+1.0
          GO TO 211
123       COUNT3=COUNT3+1.0
          GO TO 211
124       COUNT4=COUNT4+1.0
          GO TO 211
125       COUNT5=COUNT5+1.0
211       CONTINUE
          CCP=FLOAT(N)*0.2
          CHI=((COUNT1-CCP)**2)/CCP
```

```
      CH2=((COUNT2-CCP)**2)/CCP
      CH3=((COUNT3-CCP)**2)/CCP
      CH4=((COUNT4-CCP)**2)/CCP
      CH5=((COUNT5-CCP)**2)/CCP
      CHISQ=CH1+CH2+CH3+CH4+CH5
      XCHQ(I3)=CHISQ
111   CONTINUE
      WRITE(3,12)STN,(XCHQ(IY),IY=1,7)
12    FORMAT(,X,I3,4X,7F8.3)
      GO TO 99
9     STOP
      END
```

```
C     DOUBLE EXPONENTIAL DISTRIBUTION FUNCTION
C     (IT CALCULATES THE EXPECTED RAINFALL OF DIFFERENT RAINFALL
C     STATIONS FOR DIFFERENT RETURN PERIODS)
      DIMENSION NYR(30),A(30),A1(30),A2(30),A3(30),A4(30),A5(30),
     +A6(30),A7(30),SIGMA(30),YBAR(30),RP(10),LD(10),XT(20)
      DATA LD/1,2,3,5,7,10,15/
      DATA RP/2.0,5.0,10.0,20.0,50.0,100.0/
      READ(1,1)(SIGMA(I1),YBAR(I1),I1=15,25)
1     FORMAT(2F10.5)
99    READ(1,2,END=9)STN,N
2     FORMAT(2I3)
      DO 333 I2=1,N
      READ(1,3)(NYR(I2),A1(I2),A2(I2),A3(I2),A4(I2),A5(I2),A6(I2),
     +A7(I2))
333   CONTINUE
3     FORMAT(2X,I4,7(4X,F6.1))
      DO 111 I3=1,7
      GO TO (100,200,300,400,500,600,700),I3
100   DO 101 J1=1,N
101   A(J1)=A1(J1)
      WRITE(3,31)STN
31    FORMAT(1H1,5X,'STATION NO.=',2X,I3,/,50X,'RETURN PERIOD')
      WRITE(3,34)
34    FORMAT(80('_'),/,2X,'DAY',10X,'(2)',8X,'(5)',9X,'(10)',8X,'(20)',
     +8X,'(50)',7X,'(100)')
      GO TO 1000
200   DO 201 J2=1,N
201   A(J2)=A2(J2)
      GO TO 1000
300   DO 301 J3=1,N
301   A(J3)=A3(J3)
      GO TO 1000
400   DO 401 J4=1,N
401   A(J4)=A4(J4)
      GO TO 1000
500   DO 501 J5=1,N
501   A(J5)=A5(J5)
      GO TO 1000
600   DO 601 J6=1,N
601   A(J6)=A6(J6)
      GO TO 1000
700   DO 701 J7=1,N
701   A(J7)=A7(J7)
1000  SUM=0.0
      DO 55 KK=1,N
      SUM=SUM+A(KK)
55    CONTINUE
      XMEAN=SUM/FLOAT(N)
      SSUM=0.0
      DO 44 KM=1,N
      SSUM=SSUM+(A(KM)-XMEAN)**2
44    CONTINUE
      STD=SQRT(SSUM/N)
      VBETA=STD/SIGMA(N)
      VU=XMEAN-YBAR(N)*VBETA
      DO 33 II=1,6
      XX=RP(II)/(RP(II)-1.0)
      XZ=ALOG(XX)
      XC=ALOG(XZ)
      XT(II)=VU-VBETA*XC
33    CONTINUE
```

```
      WRITE(3,26)LD(13),(XT(IT),IT=1,6)
26    FORMAT(1X,13,2X,6F12.2)
111   CONTINUE
      GO TO 99
9     STOP
      END



C     THIS PROGRAMME CHECKS THE RESULTS(FINDS OUT ERRORS)
      DIMENSION RP(10),XZ(450),F(90),F1(70),F2(70),F3(70),Y(450),A(70),
     +F4(70),F5(70),F6(70),CY(450,10),IZ(450),Z1(450),Z2(450),XM(90),
     +Z3(450),Z4(450),Z5(450),Z6(450),Z(450),JS(60)
      DATA A/198.41,265.62,309.67,351.83,410.55,454.05/
      DATA XM/0.452,0.432,0.425,0.425,0.425,0.426/
      DATA RP/2.0,5.0,10.0,20.0,50.0,100.0/
      DATA JS/165,220,197,157,161,200,192,152,183,174,177,180,154,160,
     +213,157,166,177,207,155,221,197,210,169,192,201,195,203,206,153,
     +185,222,215,163,156,181,152,199,187,194,217,158,185,191,151,8,
     +24,33,40,16,23,184,38,4,25/
      DO 28 I=1,55
      READ(1,1)KH,F1(I),F2(I),F3(I),F4(I),F5(I),F6(I)
      WRITE(3,16)KH,F1(I),F2(I),F3(I),F4(I),F5(I),F6(I)
1     FORMAT(I4,1X,6F9.2)
16    FORMAT(2X,I4,6F9.2)
28    CONTINUE
      READ(1,2)(IZ(I),Z1(I),Z2(I),Z3(I),Z4(I),Z5(I),Z6(I),I=1,385)
C     WRITE(3,2)(IZ(I),Z1(I),Z2(I),Z3(I),Z4(I),Z5(I),Z6(I),I=1,385)
2     FORMAT(I5,2X,5F12.2)
      DO 88 IB=1,385
88    XZ(IB)=FLOAT(IZ(IB))
      NN=385
      DO 11 IJ=1,6
      GO TO(100,200,300,400,500,600),IJ
100   DO 101 J1=1,NN
101   Y(J1)=Z1(J1)
      DO 99 K1=1,55
99    F(K1)=F1(K1)
      GO TO 1000
200   DO 201 J2=1,NN
201   Y(J2)=Z2(J2)
      DO 199 K1=1,55
199   F(K1)=F2(K1)
      GO TO 1000
300   DO 301 J3=1,NN
301   Y(J3)=Z3(J3)
      DO 299 K1=1,55
299   F(K1)=F3(K1)
      GO TO 1000
400   DO 401 J4=1,NN
401   Y(J4)=Z4(J4)
      DO 399 K1=1,55
399   F(K1)=F4(K1)
      GO TO 1000
500   DO 501 J5=1,NN
501   Y(J5)=Z5(J5)
      DO 499 K1=1,55
499   F(K1)=F5(K1)
      GO TO 1000
600   DO 601 J6=1,NN
601   Y(J6)=Z6(J6)
      DO 599 K1=1,55
599   F(K1)=F6(K1)
1000  IY=1
      IL=7
      DO 44 IN=1,55
      DO 33 IP=IY,IL
      CIY=A(IJ)*(XZ(IP)**XM(IJ))*F(IN)
      CY(IP,IJ)=(ABS(Y(IP)-CIY)/Y(IP))*100.0
33    CONTINUE
      IY=IY+7
      IL=IL+7
44    CONTINUE
11    CONTINUE
      NB=7
      NC=1
      DO 888 II=1,55
```

```
      WRITE(3,18)JS(II)
18    FORMAT(///,5X,'STATION NO.',I7,/,60('-'),/)
      WRITE(3,4)((CY(I1,I2),I2=1,6),I1=NC,NB)
4     FORMAT(5X,6F9.2)
      WRITE(3,17)
17    FORMAT(//)
      NC=NC+7
      NB=NB+7
888   CONTINUE
      STOP
      END
/DATA
 165      0.93      0.93      0.92      0.91      0.77      0.78
 220      0.90      0.87      0.86      0.84      0.81      0.79
 197      0.85      0.96      0.86      0.85      0.93      0.92
 157      0.93      0.88      0.85      0.82      0.78     00.74
 161      0.83      0.79      0.76      0.74      0.71      0.69
 200      0.76      0.78      0.79      0.77      0.76      0.75
 182      0.73      0.80      0.82      0.83      0.83      0.83
 159      0.92      0.70     00.87     00.84     00.80     00.79
 183      0.77      0.80      0.80      0.79      0.79      0.77
 174      0.72      0.72      0.71      0.79      0.83      0.86
 177      0.74      0.82      0.85      0.87      0.87      0.88
 188      0.78      0.83      0.85      0.95      0.85      0.85
 154      0.55      0.56      0.55      0.55      0.54      0.53
 160      0.72      0.72      0.71      0.71      0.69      0.68
 213      0.72      0.71      0.70      0.69      0.67      0.65
 167      0.83      0.77      0.74      0.72      0.69      0.68
 166      0.77      0.77      0.77      0.76      0.75      0.74
 179      0.73      0.71     00.71     00.69     00.67     00.65
 209      0.97      1.00      1.00      1.00      0.98      0.97
 155      0.74      0.86      0.91      0.94      0.96      0.97
 221      0.84      0.85      0.85      0.84      0.92      0.91
 199      0.57      0.62      0.63      0.64      0.64      0.64
 210      0.68      0.69      0.68      0.69      0.66      0.65
 168      0.57      0.62      0.53      0.63      0.63      0.62
 189      0.84      0.70      0.72      0.73      0.73      0.73
 201      0.65      0.71      0.73      0.74      0.74      0.74
 195      0.53      0.68      0.69      0.70     00.68     00.67
 203      0.56      0.55      0.55      0.54     00.52     00.51
 206      0.70      0.74      0.75      0.76      0.75      0.74
 153      0.73      0.72      0.72      0.72      0.71      0.71
 186      0.91      0.83      0.84      0.94      0.83      0.82
 222      0.75      0.79      0.81      0.91      0.81      0.80
 215      0.56      0.63      0.66      0.68      0.69      0.70
 163      0.73      0.78      0.79      0.80      0.80      0.79
 156      0.65      0.70      0.71      0.72      0.72      0.71
 181      0.61      0.69      0.72      0.74      0.75     00.75
 152      0.56      0.62      0.64      0.65      0.65      0.56
 198      0.58      0.63      0.65      0.55      0.65      0.65
 187      0.56      0.59      0.50      0.61      0.61      0.60
 194      0.45      0.53      0.54      0.55     00.56     00.56
 219      0.54      0.57      0.58     00.57     00.57     00.56
 158      0.54      0.57      0.72      0.75      0.77      0.70
 185      0.53      0.59      0.61      0.62      0.62     00.63
 191      0.55      0.57      0.58      0.59      0.59      0.57
 151      0.53      0.53      0.53      0.53      0.52      0.51
   8      0.54      0.58      0.59      0.50      0.60      0.60
  24      0.55      0.55      0.55      0.55      0.54      0.54
  33      0.65      0.70      0.71      0.72     00.73     00.72
  40      0.57      0.51      0.62      0.62      0.62      0.62
  16      0.55      0.58      0.60      0.60      0.60      0.60
  23      0.54      0.51      0.63     00.63     00.63     00.63
 184      0.52      0.57      0.59      0.60      0.60      0.60
  38      0.48      0.50      0.51      0.51     00.48     00.48
   4      0.51      0.57      0.59      0.60      0.50     00.60
  25      0.51      0.58      0.61      0.63      0.54      0.54

C     THIS PROGRAM FITS LEAST SQUARE LINE TO THE DATA OBTAINED BY
C     STAT PROGRAM (THROUGH MAX. POINTS)
      DIMENSION RP(10),XX(450),Y(90),Y1(450),Y2(450),Y3(450),
     * Y4(450),Y5(450),Y6(450),CY(450,10),IZ(450),Z1(90),Z2(90),
     * Z3(90),Z4(90),Z5(90),Z6(90),IX(90),X(90),Z(450),SY(450,10)
      DATA RP/2.0,5.0,10.0,20.0,50.0,100.0/
```

```
      READ(1,1)(IZ(I),Y1(I),Y2(I),Y3(I),Y4(I),Y5(I),Y6(I),I=1,77)
C     WRITE(3,1)(IZ(I),Y1(I),Y2(I),Y3(I),Y4(I),Y5(I),Y6(I),I=1,77)
1     FORMAT(I5,2X,6F12.2)
      DO 88 IB=1,77
88    XX(IB)=FLOAT(IZ(IB))
      READ(1,56)(IX(I),Z1(I),Z2(I),Z3(I),Z4(I),Z5(I),Z6(I),I=1,7)
C     WRITE(3,56)(IX(I),Z1(I),Z2(I),Z3(I),Z4(I),Z5(I),Z6(I),I=1,7)
56    FORMAT(I3,6F10.2)
      DO 66 II=1,7
66    X(II)=FLOAT(IX(II))
      NN=77
      N=7
      DO 11 IJ=1,6
      GO TO(100,200,300,400,500,600),IJ
100   DO 101 J1=1,N
101   Y(J1)=Z1(J1)
      DO 99 K1=1,NN
99    Z(K1)=Y1(K1)
      GO TO 1000
200   DO 201 J2=1,N
201   Y(J2)=Z2(J2)
      DO 199 K2=1,NN
199   Z(K2)=Y2(K2)
      GO TO 1000
300   DO 301 J3=1,N
301   Y(J3)=Z3(J3)
      DO 299 K3=1,NN
299   Z(K3)=Y3(K3)
      GO TO 1000
400   DO 401 J4=1,N
401   Y(J4)=Z4(J4)
      DO 399 K4=1,NN
399   Z(K4)=Y4(K4)
      GO TO 1000
500   DO 501 J5=1,N
501   Y(J5)=Z5(J5)
      DO 499 K5=1,NN
499   Z(K5)=Y5(K5)
      GO TO 1000
600   DO 601 J6=1,N
601   Y(J6)=Z6(J6)
      DO 599 K6=1,NN
599   Z(K6)=Y6(K6)
1000  SUMX=0.0
      SUMY=0.0
      SUMXY=0.0
      SUMX2=0.0
      DO 22 IK=1,N
      SUMX=SUMX+ALOG(X(IK))
      SUMY=SUMY+ALOG(Y(IK))
      SUMXY=SUMXY+ALOG(X(IK))*ALOG(Y(IK))
      SUMX2=SUMX2+ALOG(X(IK))*ALOG(X(IK))
22    CONTINUE
      XM=(FLOAT(N)*SUMXY-SUMX*SUMY)/(FLOAT(N)*SUMX2-SUMX**2)
      AC=(1.0/FLOAT(N))*(SUMY-XM*SUMX)
      A=EXP(AC)
      WRITE(3,3)A,XM,RP(IJ)
3     FORMAT(4X,'A='E12.5,/,5X,'M=',F10.6,/,5X,'RP='F5.1)
      DO 33 IP=1,NN
      CIY=A*(XX(IP)**XM)
      CY(IP,IJ)=(ABS(Z(IP)-CIY))/Z(IP)
      SY(IP,IJ)=Z(IP)/CIY
33    CONTINUE
11    CONTINUE
C     WRITE(3,4)((CY(I1,I2),I2=1,6),I1=1,77)
4     FORMAT(4X,6F12.2)
      WRITE(3,41)
41    FORMAT(//,5X,'TABLE OF RATIOS',///)
      WRITE(3,42)((SY(I1,I2),I2=1,6),I1=1,77)
42    FORMAT(4X,6F12.2)
      STOP
      END
8M81I  OBJMAIN STATISTICS  SYS004=001202, SYS005=000000, SYSLST=001204
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বাংলাদেশ প্রকৌশল বিশ্ববিদ্যালয়
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