

## DEPTH DURATION STUDIES OF LONG PERIOD RAINFALL

1. Extreme values of rainfall of different durations for different return periods are required in many hydrological design problems. The durations for which the return period values are required depend upon the particular hydrological problem. For the computation of design discharges from certain catchments or in flood computation problems depths of specific rainfall are required not only for durations of less than one day but also for higher durations such as two days, three days etc. Some studies in this direction have been made for regions in United States (U.S. Weath. Bur. 1958). Such data are not available for many areas in India.

The results of a preliminary study of this problem for some areas in India for which the data were readily available are presented in this note.

2. A study of the rainstorms during the period from 1901 to 1960 over the plains of Assam has been made by Pant *et al.* (1970). The rainstorms over North Bengal for the period 1901-1968 have also been studied by Abbi *et al.* (1976). The average isohyetal depths of precipitation for different durations for the two areas as given by them were taken and subjected to frequency analysis using

Chow's (1953) technique and rainfall depths for different durations for return periods of 5, 10, 25, 50 and 100 years were found. From these the percentage ratios of 2-day, 3-day and 4-day rainfall depths to 1-day depths were calculated.

Rainstorms have been studied by Dhar and Mhaiskar (1970) for the Bhima basin for the period 1891-1965, by Dhar *et al.* (1968) for the Godavari basin for the period 1891-1963, by Dhar and Kamte (1968) for the Baitarani basin for the period 1901-1961 and by Banerji and Anand (1966) for the Gomati catchment for the period 1901-1960. Frequency analysis of the data has also been made by the authors who have given the estimation equations for maximum rainfall. From these equations maximum rainfall for different durations for return period 5, 10, 25, 50 and 100 years were found and the required percentage ratios were calculated.

3. The 1-day extreme rainfall values for different return periods for different regions are given in Table 1.

The percentage ratios of 2-day, 3-day and 4-day extreme rainfall to 1-day extreme rainfall for different regions are shown in Table 2. It may be seen from this table that percentage ratios for different return periods are of the same order for the same area but are different for different regions.

TABLE 1

| Name of the basin | Area (sq. km) | 1-day extreme rainfall (cm) for return periods (years) |       |       |       |       |
|-------------------|---------------|--|-------|-------|-------|-------|
|                   |               | 5  | 10    | 25    | 50    | 100   |
| Assam Plains      | 9580          | 5.93   | 7.20  | 8.72  | 9.81  | 10.90 |
| North Bengal      | 12600         | 12.51  | 15.02 | 18.01 | 20.14 | 22.27 |
| Bhima             | 69520         | 6.65   | 7.98  | 9.63  | 10.92 | 12.14 |
| Godavari          | 21760         | 5.79   | 7.16  | 8.89  | 10.19 | 11.46 |
| Baitarani         | 10880         | 9.93   | 12.80 | 16.36 | 19.18 | 21.82 |
| Gomati            | 10720         | 10.54  | 12.73 | 15.49 | 17.55 | 19.58 |

TABLE 2

| Area            | 2-day extreme rainfall as percentage of 1-day extreme rainfall for return periods (years) |     |     |     |     |     | 3-day extreme rainfall as percentage of 1-day extreme rainfall for return periods (years) |     |     |     |     |     | 4-day extreme rainfall as percentage of 1-day extreme rainfall for return periods (years) |     |     |     |     |     |
|-----------------|---|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|-----|
|                 | 5   | 10  | 25  | 50  | 100 | Av. | 5   | 10  | 25  | 50  | 100 | Av. | 5   | 10  | 25  | 50  | 100 | Av. |
| Assam Plains    | 164   | 167 | 170 | 172 | 173 | 169 | 217   | 208 | 199 | 194 | 190 | 202 | 253   | 250 | 248 | 246 | 245 | 248 |
| North Bengal    | 159   | 160 | 161 | 162 | 163 | 161 | 192   | 200 | 207 | 211 | 215 | 205 | —   | —   | —   | —   | —   | —   |
| Bhima basin     | 157   | 157 | 156 | 155 | 155 | 156 | 194   | 192 | 191 | 190 | 189 | 191 | —   | —   | —   | —   | —   | —   |
| Godavari basin  | 143   | 139 | 135 | 133 | 132 | 136 | 172   | 166 | 160 | 157 | 155 | 162 | —   | —   | —   | —   | —   | —   |
| Baitarani basin | 151   | 150 | 149 | 149 | 149 | 150 | 172   | 171 | 170 | 169 | 169 | 170 | —   | —   | —   | —   | —   | —   |
| Gomati basin    | 142   | 138 | 135 | 134 | 132 | 136 | —   | —   | —   | —   | —   | —   | —   | —   | —   | —   | —   | —   |

The two-day rainfall is seen to be about 1.6 times of 1-day rainfall for Assam plains, North Bengal, Bhima basin & Baitarani basin and about 1.4 times for Godavari basin and Gomati catchment. The 3-day rainfall is found to be about twice the 1-day rainfall for Assam plains, north Bengal and Bhima basin. The 4-day rainfall is about 2.5 times the one

day rainfall for Assam plains. For North Bengal the number of occasions of high rainfall amounts continuing for four days in succession was rather small unlike the case of Assam plains.

4. The authors are thankful to Dr. P. Koteswaram, Director General of Observatories for his interest in this study.

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February 28, 1970

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