II-387

ESTIMATION OF RAINFALL DISTRIBUTION IN MAE TAENG RIVER BASIN, THAILAND

University of Tokyo, IIS　Student Member　Raghunath Jha
University of Tokyo, IIS　Member　S. Herath　K. Musiake

1. INTRODUCTION

In hydrologic modeling, rainfall is an important component to be considered. The accuracy of the model depends on the accuracy of the rainfall data that has been used. On one hand, we give emphasis to collect the rainfall and develop very sophisticated and complex mathematical model to predict the runoff, and on other hand in most of the cases the mean rainfall is calculated by either simple arithmetic mean or Thiessen polygon or isohyetal methods. However, these methods yield good estimate, if the catchment is relatively flat and the gauging stations are uniformly distributed. In the developed countries where the rain-gauge networks are sufficiently large and other advance techniques as satellite and radar are used, the above mentioned methods may give quite representative rainfall. However, in most of developing countries neither these advance techniques are available nor raingauges are distributed uniformly. Moreover, the problem becomes more acute when the catchment is mountainous, and orographic rainfall is dominant.

2. DESCRIPTION OF THE MODEL

A rainfall model on the basis of elevation and spatial distribution of raingauges as well as recorded rainfall has been developed to find out the representative rainfall over entire catchment. A linear relationship for the drift in elevation is postulated because the available studies on precipitation–elevation relationships did not seem to warrant anything more complex (Bras & Ingnacio, 1985). The parameters of the model are calculated by considering monthly rainfall. The formulation of rainfall and elevation is presented in equation 1.

$$\frac{MR_{(i)}}{M_{avg}} = A_0 + A_1 E_{(i)} \qquad (1)$$

Where, $MR_{(i)}$ and $E_{(i)}$ are monthly rainfall and elevation of i^th raingauge; M_{avg} is monthly arithmetic average of rainfall for all available stations; and A_0, A_1 are two parameters, which can be optimized by using monthly rainfall and elevation of the all rainfall gauges available in the catchment.

The daily rainfall at desired point is calculated by

$$DR_{(u)} = (A_0 + A_1 E_{(u)}) \times D_{avg} \qquad (2)$$

Where, $DR_{(u)}$ is daily rainfall at elevation $E_{(u)}$; and D_{avg} is daily rainfall average, which is calculated as:

$$D_{avg} = \frac{\sum_{i=1}^{N} \frac{r_i}{x_i}}{\sum_{i=1}^{N} \frac{1}{x_i}} \quad when \quad x_i > 0.0 \qquad (3)$$

$$= r_i \quad when \quad x_i = 0.0 \qquad (4)$$

Where, N is total number of available gauging stations in the catchment; r_i is the observed rainfall of i^{th} gauging station and x_i is the aerial distance of i^{th} gauging station from the point considered. At the location where raingauges exist only the rainfall of that station is considered as D_{avg}.

3. MODEL APPLICATION AND DISCUSSIONS

Mae Taeng catchment, which is located in north-west part of Chao Phraya river basin, near the Myanmar border at latitude $19^0 30' N$ and longitude $98^0 30' E$ as shown in Fig. 1, has been selected to apply the developed model. The total catchment area of basin is $1903 Km^2$ and surrounded by the steep mountains ranging from 1000m to 2000m. There are four raingauges in this catchment. Out of four raingauges, three are located at the lower part of the catchment and one is located near the center of the catchment (Fig. 1). The elevations of these four raingauges are nearly 300m, 350m, 800m and 1000m respectively. The daily data for these stations are available from 1980 to 1990.

The monthly summation of daily calculated and observed rainfall at elevation 300 and 1000m are shown in Figures 2 and 3 respectively. Fig 4 shows the daily observed hydrographs for 50th to 100th day of year 1980, at the same elevations. All results show good agreement between the calculated and observed rainfall. This indicates that the model can be used in mountainous tropical catchments to calculate the daily rainfall distribution over the catchment and is useful in distributed hydrological modeling where a dense raingauge network is not available.

References

Brass, L. R. & Ignalio, Rodriguez–Iturbe, (1985), Random Function and Hydrology, *Addision – Wesley Publishing Company.*

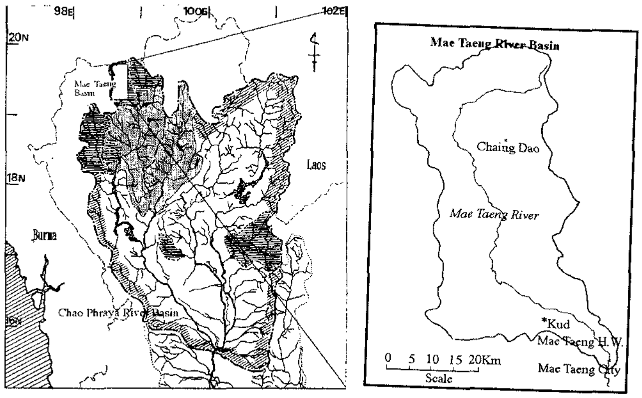

Figure 1 The Location Map of the Mae Taeng Catchment, Thailand

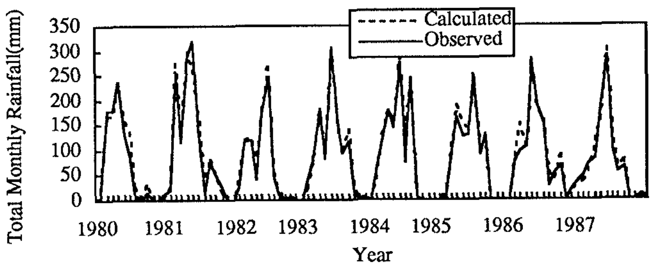

Figure 2 The Comparison Between the Total Monthly Observed and Calculated Rainfall at 300 M Elevation

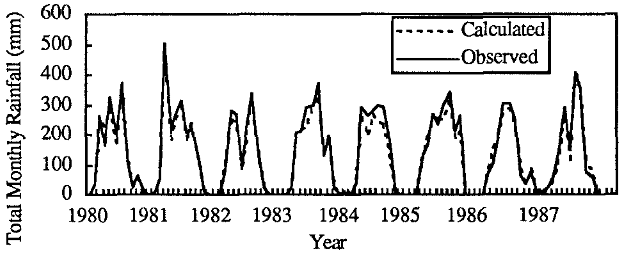

Figure 3 The Comparison Between the Total Monthly Observed and Calculated Rainfall at 1000 M Elevation

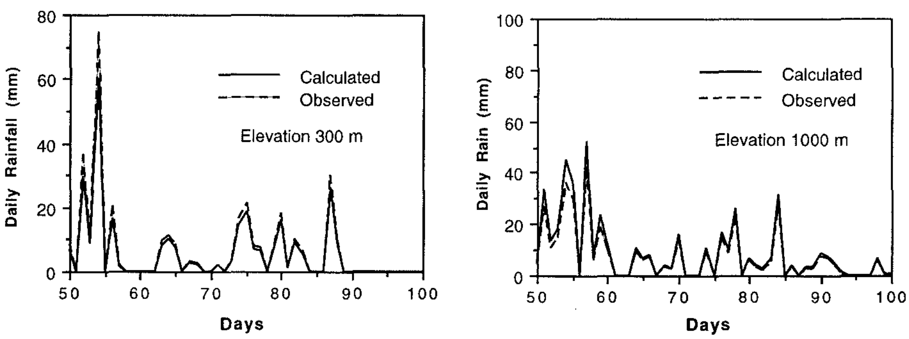

Figure 4 The Comparison Between the Daily Observed and Calculated Rainfall at Elevation 300m and 1000m for Year 1980

Toru Shimada, Kouji Nishimura, Yoshiharu Iashikawa, Tadanori Ishizuka Takashi Yamada & Thada Sukhapunnaphan (1995), Sediment yield and Transport in Tropical Area, *Proceeding of the International Sabo Symposium, Tokyo, Japan, August 1995*, pp. 409~ pp. 416.