APPLICATION OF MARTINEC-RANGO MODEL TO RIVER BASIN IN JAPAN

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INTRODUCTION

The Martinec-Rango model is known as one of the most practical models applicable to various river basins in many countries. The present study deals with the application of the model to Japan's river basins in use of the recently distributed user's manual.

One of the most important input variables of the model is the snow cover area provided by the Landsat imagery. Unfortunately, Japan is covered with much cloud during snowmelt season. Only by chance, one can obtain one or two imageries in the season. Ishihara et al [2] made effective use of a few precious imageries obtained in the past for the standardization of the snow cover depletion curve in connection with the degree-days at a representative point. The model was applied to the Okutadami River Basin, using the same variable data of three snowmelt seasons in 1979, 1980 and 1982 as used in the study by Ishihara et al [2].

APPLICATION OF THE MODEL

The Martinec-Rango Model is expressed by the following equation:

$$Q_{n+1} = C_n\ [\alpha_n\ (T_n+\Delta\ T_n)\ S_n+P_n]\ \frac{A \cdot 0.01}{86400}\ (1-k_{n+1})+Q_n k_{n+1} \qquad (1)$$

Variables

$(T_n+\Delta T_n)$ in the equation (1) is given the temperature at Maruyama located roughly at the mean altitude .of the basin. The relation between elevation-snow cover area curves is provided by Fig. 1. P_n is assigned by the precipitation at Hinoemata located slightly outside the basin. Q_n is the daily inflow into the reservoir, S_n is given in Ishihara et al [2].

Parameters

Both two coefficients c_n and α_n were evaluated 1.2 and 0.45 [g/°C•day] respectively. The relation of Q_n vs Q_{n+1} shown in Fig. 2 gave the recession equation:

$$k_n = 0.986 Q_{n-1}{}^{-0.059}$$

This equation is of the intermediate line between the 1:1 line and the lower envelope line.

Results

The thus calculated inflow for three snowmelt seasons is shown in Figures 3, 4 and 5 in conjunction with the observed inflow. When the peak inflow occurs, two values of the calculated and the observed do not coincide with each other. One day lag can be seen between them. However, the most period in the season except such peak stage exhibited a good agreement.

According to the user's manual, it may be good that the test basin is divided into two or three zones.

The altitudes of the highest and lowest points in the basin are 2,346 m and 782 m respectively. The altitude difference is 1,564 m.

REFERENCES

1. Martinec, J., A. Rango and E. Major (1983): The Snowmelt-Runoff Model (SRM) User's Manual. NASA Reference Publication 1100, p. 1-110.

2. Ishihara, K., Y. Nishimura and K. Takeda (1983): Snowmelt runoff model in Japan. Paper Presented at Final Japan/US Snow and Evapotranspiration Workshop, Nov. 1983, Hawaii.

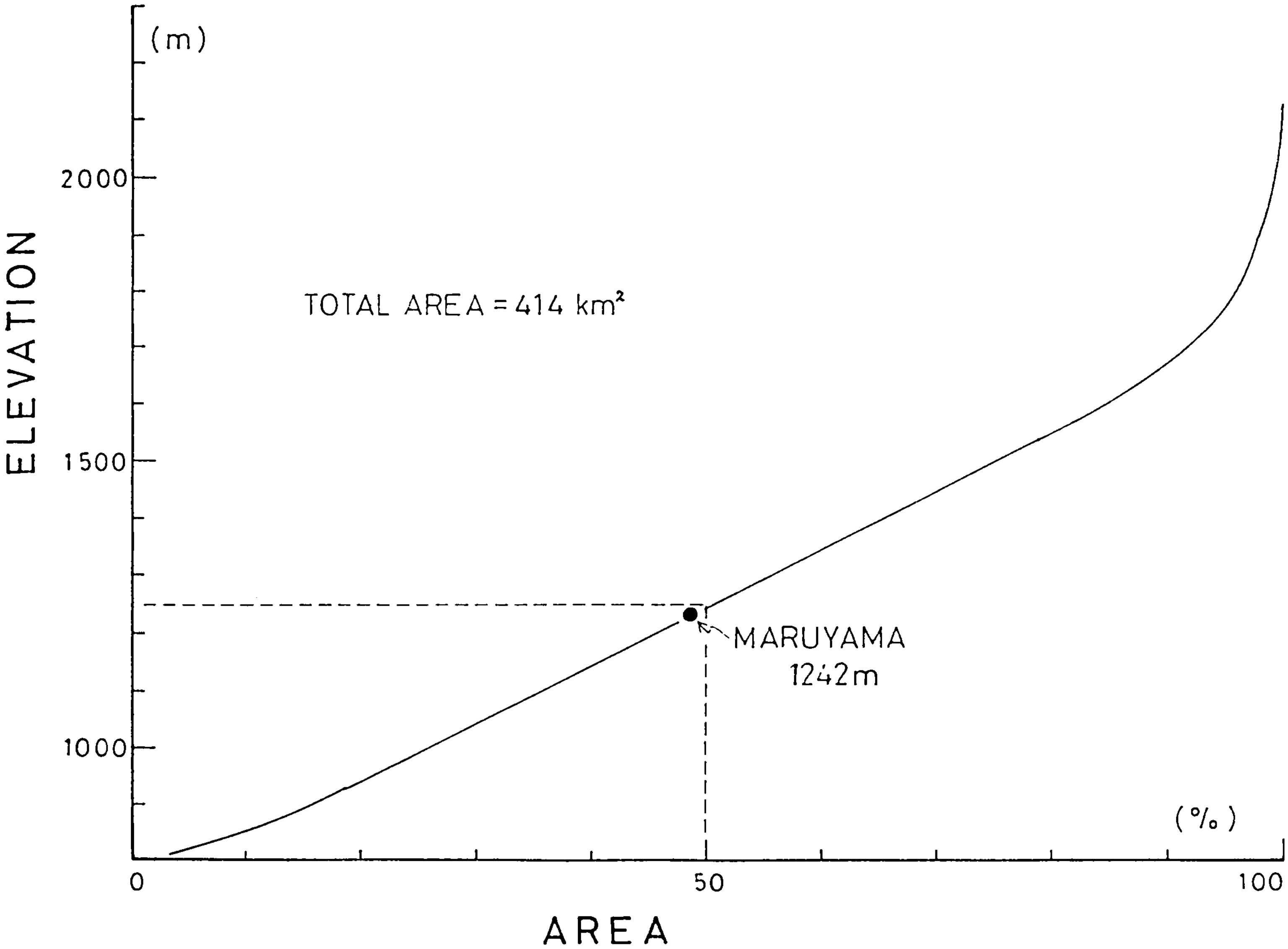

Figure 1. Relation of Elevation vs Area for the Okutadami Basin

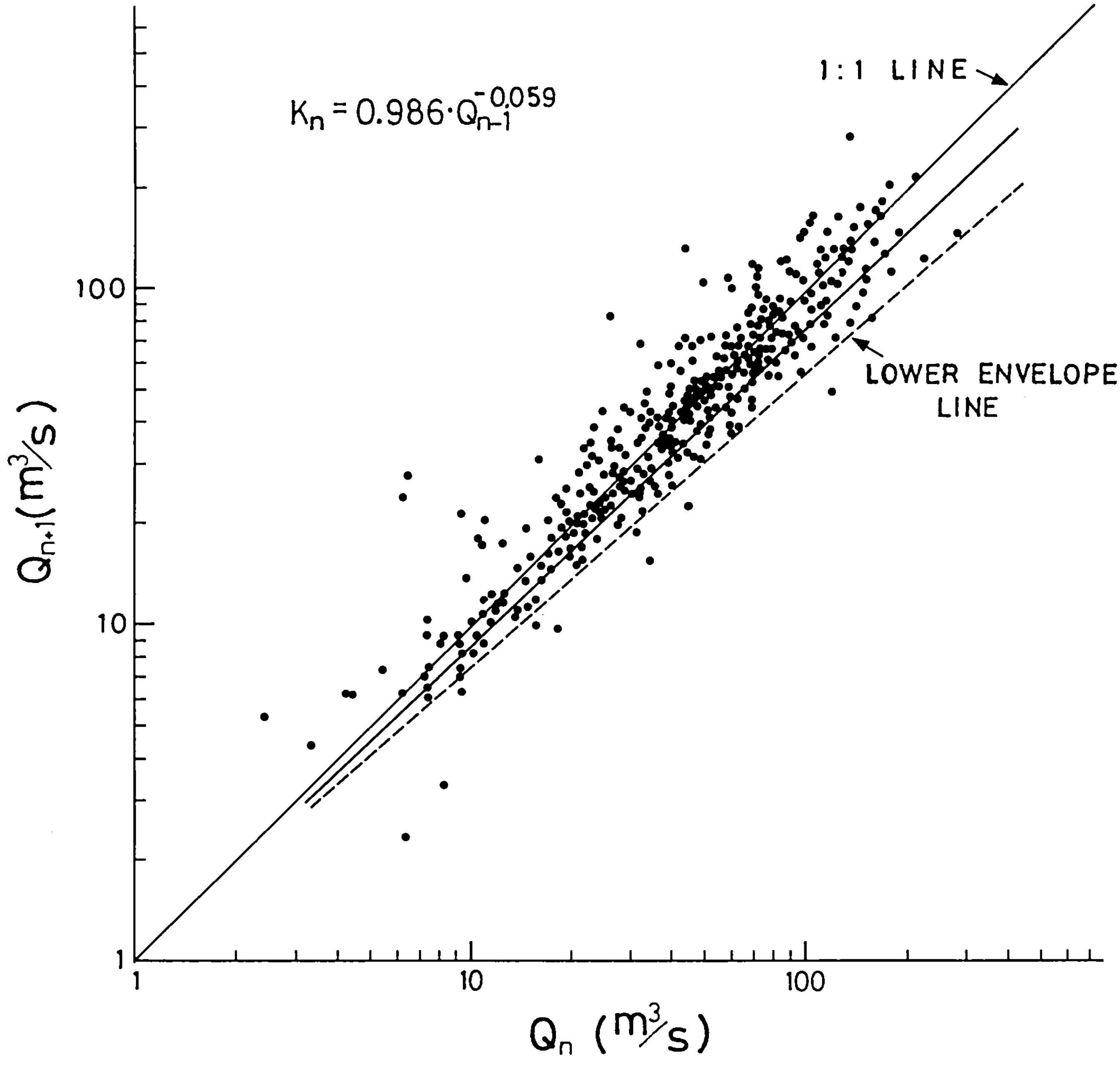

Figure 2. Recession Flow Plot, Q_n vs Q_{n+1} for the Okutadami Basin

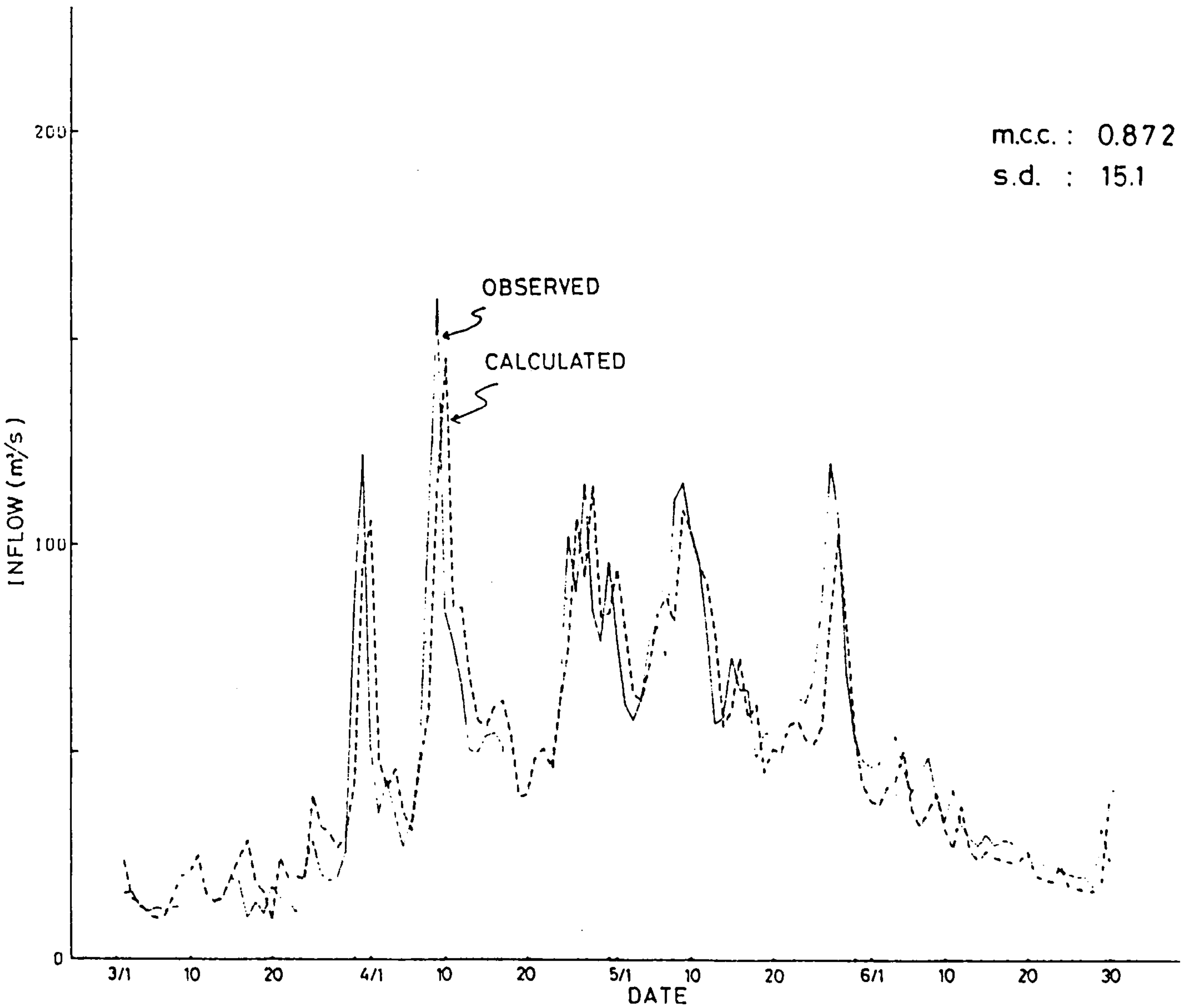

Figure 3. Comparison Between Observed (Solid Line) and Calculated (Broken Line) Inflow in Use of MARTINEC-RANGO MODEL for 1979 Snowmelt Season

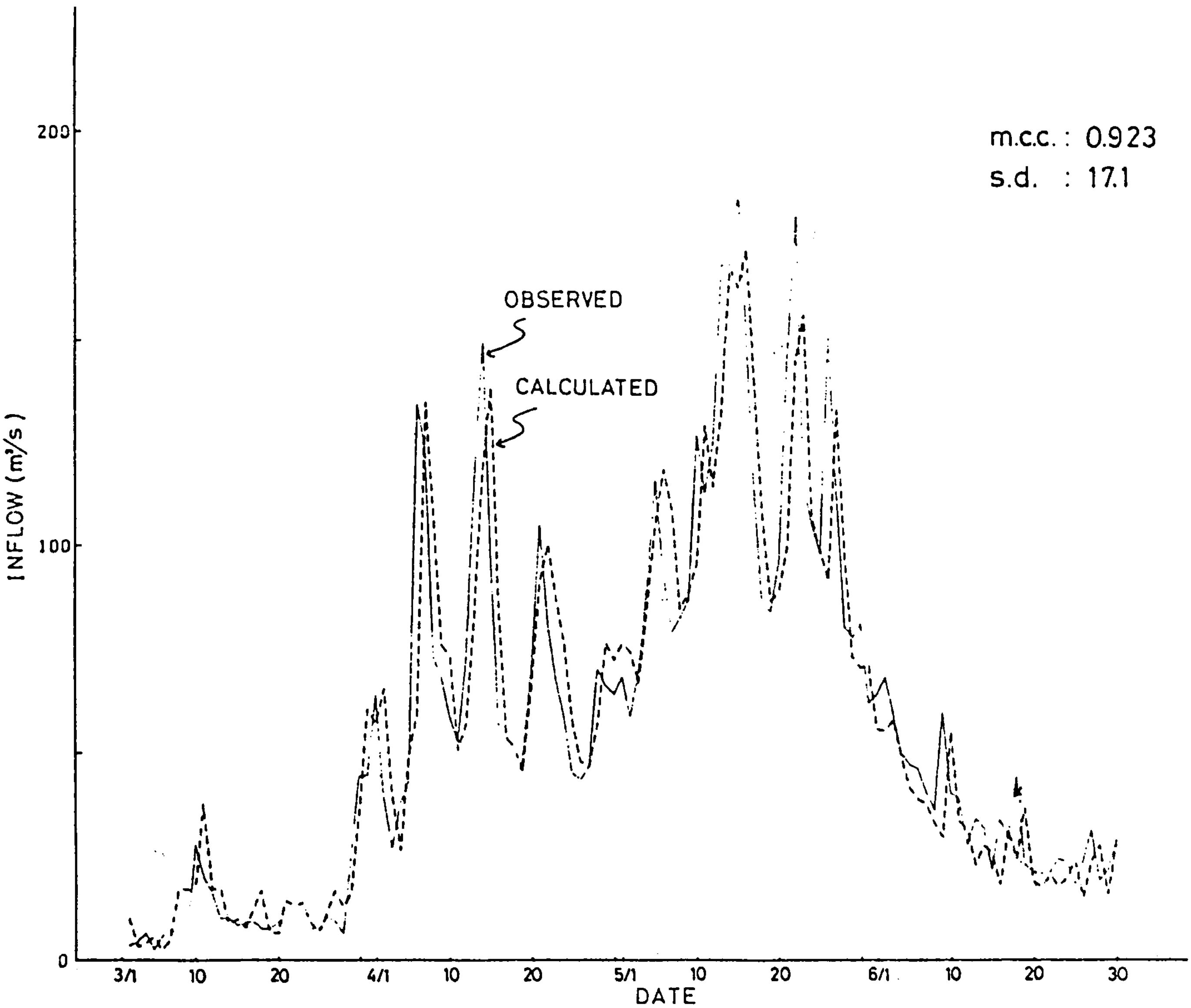

Figure 4. Comparison Between Observed (Solid Line) and Calculated (Broken Line) Inflow in Use of MARTINEC-RANGO MODEL for 1980 Snowmelt Season

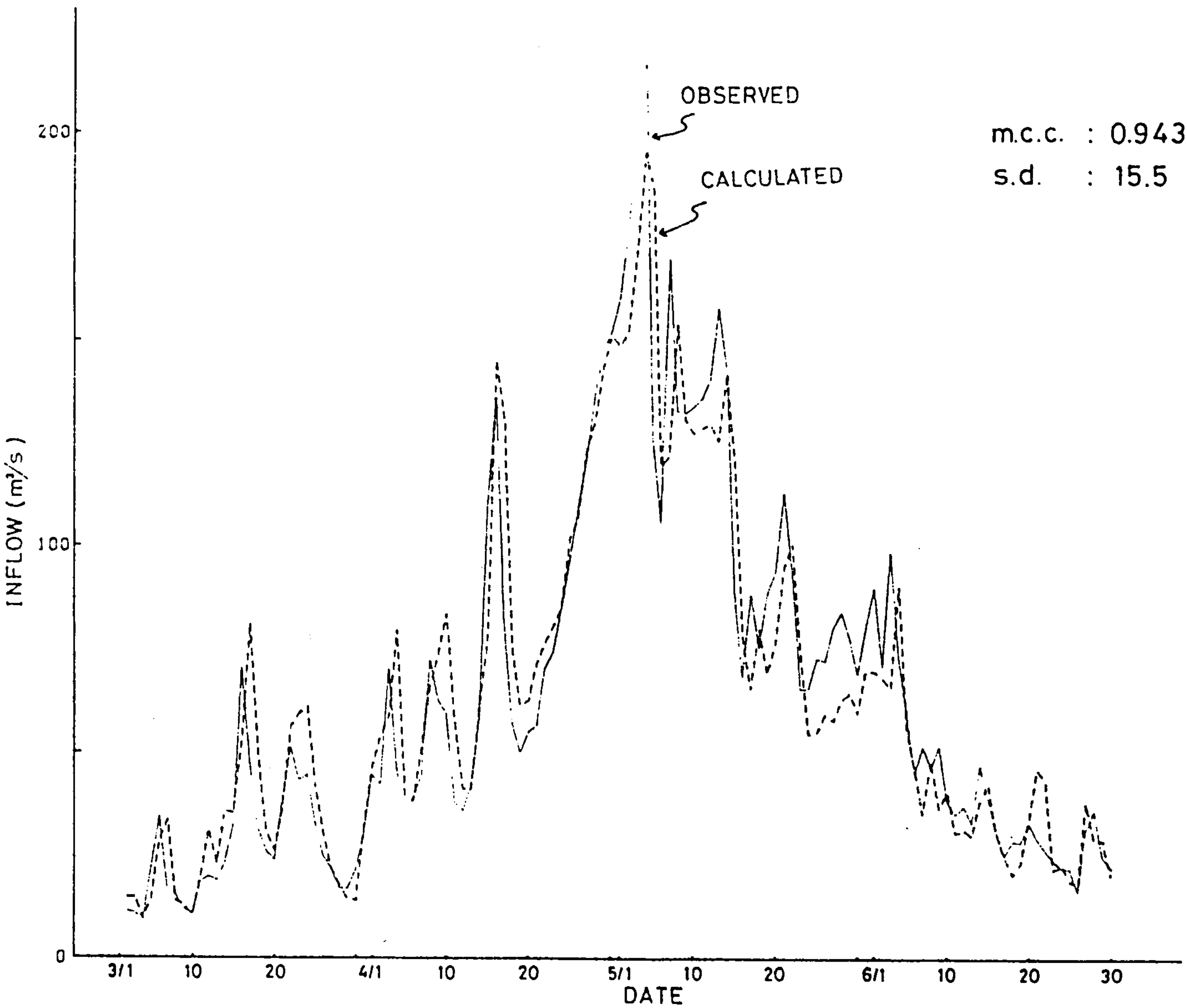

Figure 5. Comparison Between Observed (Solid Line) and Calculated (Broken Line) Inflow in Use of MARTINEC-RANGO MODEL for 1982 Snowmelt Season