โค้งอัตราการไหล-ช่วงเวลาเชิงภูมิภาคสำหรับลุ่มน้ำวัง

Regional Flow Duration Curves for Wang River Basins

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บทคัดย่อ: ในการศึกษาครั้งนี้ ได้จัดทำโค้งอัตราการไหล-ช่วงเวลาเชิงภูมิภาค สำหรับลุ่มน้ำวัง วิธีการประกอบด้วย การคัดเลือกสถานีวัดน้ำท่าจำนวน 10 สถานี มีความยาวข้อมูลอัตราการไหลรายวันไม่ต่ำกว่า 10 ปี ขนาดพื้นที่รับน้ำฝนอยู่ระหว่าง 95.7 ถึง 10,442 ตารางกิโลเมตร มาทำการวิเคราะห์สร้างโค้งอัตราการไหล-ช่วงเวลา และโค้งอัตราการไหล-ช่วงเวลาไร้มิติ ในการวิเคราะห์เชิงภูมิภาคได้แบ่งพื้นที่ศึกษาออกเป็น 3 กลุ่ม ที่มีความคล้ายคลึงเชิงอุทกวิทยา ในแต่ละกลุ่มได้สร้างโค้งอัตราการไหล-ช่วงเวลาไร้มิติที่เป็นตัวแทน และได้เสนอสมการความสัมพันธ์ที่เหมาะสมระหว่าง อัตราการไหลเฉลี่ย และเปอร์เซ็นต์เวลาสูงสุด กับตัวแปรกายภาพลุ่มน้ำ ซึ่งสามารถนำมาใช้งานร่วมกันในการประเมินหาโค้งอัตราการไหล-ช่วงเวลาที่จุดใด ๆ ในพื้นที่ศึกษา

Abstract: In this studies, the regional flow duration curves were prepared for Wang River Basins. More than 10-year daily flow records of 10 selected gauging stations in these river basins (catchment areas ranging from 95.7 to 10,442 square kilometers) were used in the analysis. The flow duration curves and dimensionless flow duration curves were construced at the gauging stations. In the regional analysis, river basins were devided into 3 subregions of similar hydrological condition. The regional flow duration curves models were constructed for each subregion, in which an equations for predicting the mean dischage and the maximum percent of time from physical parameters of the catchment were proposed for each subregion .The curves and equations obtained from this study could be used to estimate the design flow duration curve of any specified percent of time at any location, gauged or unguaged, within these river basins.

Introduction: Development planning for water resources of Wang River Basins, the flow rate is quite necessary for managing water, which has presently been insufficient, so as to maximize the benefit. An analysis to study the daily flow of run-off water is derived from flow-duration curve that is the accumulation curve used to present the total percent of time (T) which the flow (Q) is not less than the defined value. In the river basin of which the data is not identified, the flow-duration curve can be obtained by implementing the regional

analysis for searching the representative curve that consequently is used to synthesize the flow-duration curve.

Methodology: Referring to the criteria of U.S.Geological Survey [1], flow-duration curves from selected stations of river basin are created by using data of daily run-off water that reflects the natural characteristics and continually collected for more than 10 years. From the obtained flow-duration curves, the dimensionless flow-duration curves Q/Q_{mean} and T/T_{max} are then plotted. Therefore, by considering on the percentage of monthly water transmission, physical data and the distribution of dimensionless flow-duration curves, the gauged stations that have hydrological similarity can be grouped. Each group of gauged stations has the representative curve that is derived by calculating from $(Q/Q_{mean})_{max}$, $(Q/Q_{mean})_{min}$ and $(Q/Q_{mean})_{average}$ at any value of T/T_{max} of dimensionless flow-duration curves. The complex polynomial regressive equation of the representative curve, the complex regressive analysis of Q_{mean} and T_{max} in conjunction with physical data (A, L, L_C, S and Soil) can be synthesized for the flow-duration curve.

esults, Discussion and Conclusion : By analyzing the data of daily run-off water that is selected from 10 gauged stations in Wang basin, flow-duration curves can be obtained and each can be considered separately to be 3 stages. The first stage of curve, at T = 0-25, is a concave curve with steep sloped that is representing the high value of flow. Whilst the second stage of curve, at T = 25-75, is quite a flat line with slight sloped that show the normal value of flow. The last stage, at T = 75-100, has a convex curve and steep slope that identifies the low value of flow. Apart from that, the curvature of time-duration curve at the origin station has more steepness of slope than those of time-duration curve at the destination station. The result of grouping gauged stations is divided into 3 groups (W-1, W-2 and W-3) that have boundaries shown in figure 1 and also have the dimensionless time-duration representative curves as presented in figure 2.

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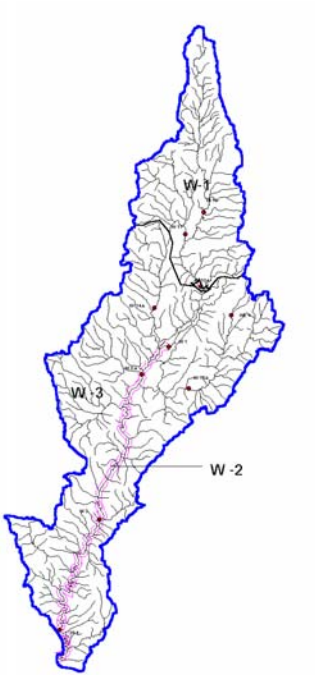

Figure 1

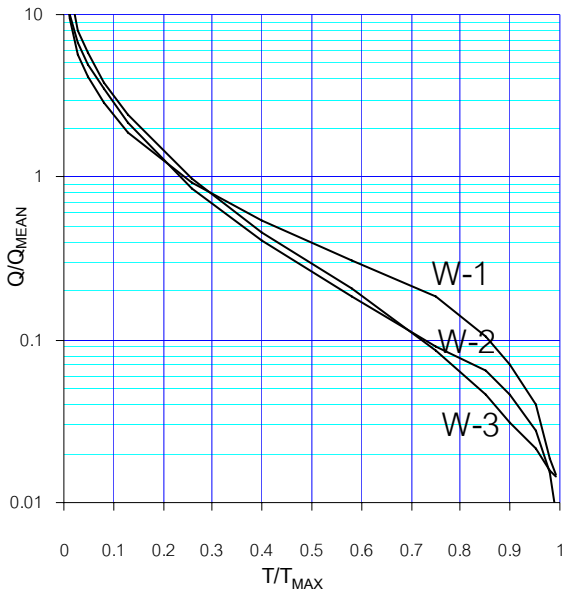

Figure 2

This study has proposed the relation equation (Qmean and Tmax) to be $IA^{II}L^{III}L_C^{IV}S^{V}Soil^{VI}$ where $R^2 \geq 0.9$ and Sig. $F \leq 0.05$. The results of equation have been shown in table 1 and can be applied to synthesize for the time-duration curve at any point as illustrated in figure 3.

Table 1

grow	I	II	III	IV	V	VI
			Q_{mean}			
W-1	0.006	1.360	-0.863	-0.025	-0.223	-1.081
W-2	0.006	1.360	-0.863	-0.025	-0.223	-1.081
W-3	0.000	2.166	-3.678	3.407	1.196	-0.240
			T_{max}			
W-1	94.313	0.015	0.106	-0.046	-0.024	-0.772
W-2	94.313	0.015	0.106	-0.046	-0.024	-0.772
W-3	19.236	0.463	-0.654	0.647	0.255	-1.200

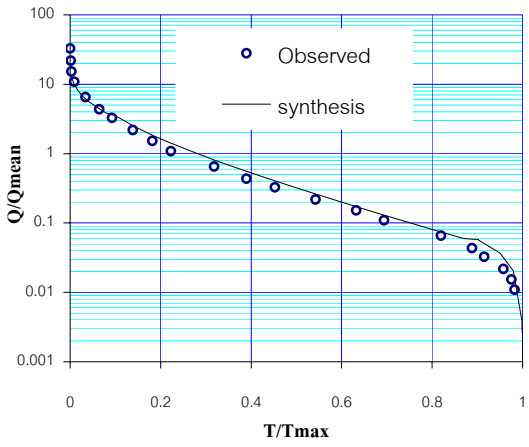

Figure 3

This figure shows the result of W 3 station in W-2 group. Comparing the results to the actual data of T/Tmax ranging from 0.002 to 0.95, it is found that there is less than 15 % error and this can be acceptable. There is quite more error during the third stage of curve, which is at T = 75-100 and also has the low value of flow, therefore design by using the data of this stage should be alert. Nonetheless, the flow at T=50-100 is the most preferable value in designing and planning projects. The analysis for this stage should be elaborately done in the next study

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