Runoff characteristics and water balance at Lambir hills catchment

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Introduction

Rainfall-runoff analysis is essential to estimate utilizable water resource, soil water storage, sediment discharge and so on. In particular, one of the major triggers of general flowering at the Lambir hills national park is said to be drought or shortage of soil water. Therefore clarification of rainfall-runoff process is of great importance to understand ecological environment. In this report, we show the stream discharge of continuous two month and tentative water budget analysis during this period.

Study site

Stream flow is observed in the Lambir hills national park (fig. 1, CL point). The basin area of CL watershed is 26.5 ha. This watershed includes the ecological and micrometeorological observation crane. Rainfall is observed at the counter jib of the crane to eliminate the influence of canopy interception of rainfall. The distribution of topsoil depth (fig. 2) is observed with the knocking cone penetrate meter (Tsukuba Maruto Co.) and the average topsoil depth is 2.27 m in this watershed.

Method of measuring stream flow

Stream flow has been observed by recording the water height at CL point where bedrock is exposed, stream flow velocity become zero temporally at natural pool and rapid flow is generated at the outlet of the pool. The estimated relationship between water height (H [m]) and discharge (Q [m^3/s]) was calculated as the same method as free fall from weir. Discharge at water height h_0 is calculated as:

$Q(h_0) = \int_0^{h_0} C \cdot f(h) \cdot v(h) dh$ where C : contracted coefficient (=0.6), $f(h_0)$: width of cross section at $h=h_0$ and v : flow velocity $v(h) = \sqrt{2g(h_0 - h)}$ (see fig. 3). The observed stream flow was checked by observing the distribution of flow velocity with propeller type current meter (every 10 or 20 cm horizontally and every 2 cm vertically) at high water height or collecting whole water at low water height. Fig. 4 shows the good relationship between the estimated HQ curve and observed data. The maximum water height during analysis period was 0.21 m, we therefore could translate the recording water height to discharge quantity with good accuracy.

Results

Fig.5 shows the hydrograph of CL watershed. The total rainfall and total discharge from 13th June 2005 to 13th August 2005 are 264.0 mm and 28.5 mm respectively. The tentative water loss calculated by subtracting discharge from rainfall is 235.5 mm (3.80 mm/day). This value shows good agreement with evapo-transpiration loss analyzed by micrometeorological method by Kumagai *et al.* 2005. This result implies that other water losses such as infiltration into deeper layer are very little. Fig. 6 shows the two days hydrograph. Initial discharge peak was observed while raining and secondary discharge peak was also observed about six hours after the cease of rainfall. The source of initial discharge peak is thought to be rainfall on the stream or near stream because it has no time lag with rainfall, and that of secondary discharge peak is rainfall on the slope and infiltrated soil water. It is revealed that this watershed has two different discharge peaks that have quite different pathway and water source.

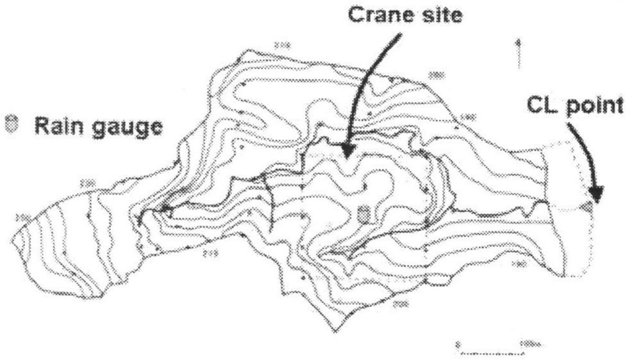

Fig.1 Topographical map of CL watershed, Lambir hills national park

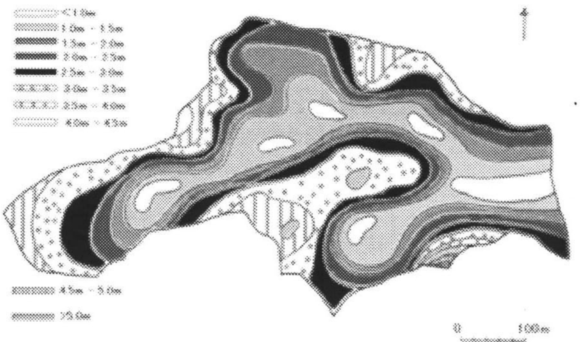

Fig.2 Topsoil distribution of CL watershed

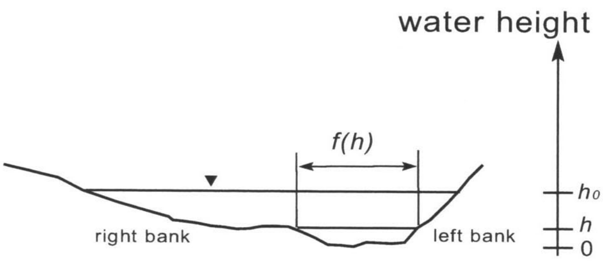

Fig.3 Cross section at CL rapid flow point; distribution of flow velocity was checked.

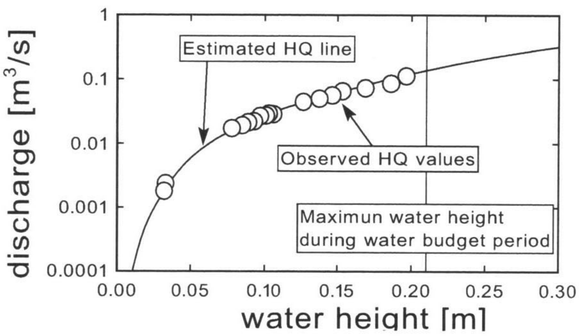

Fig.4 Estimated HQ curve and observed HQ values

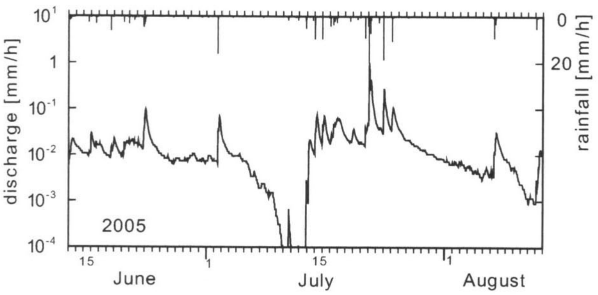

Fig.5 Hydrograph of CL watershed

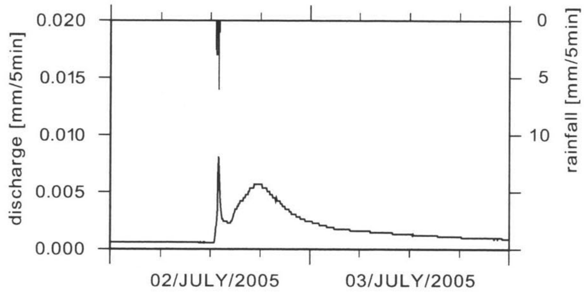

Fig.6 Initial and secondary discharge peak of CL watershed.

REFERENCES

Kumagai *et al.*, 2005. Annual water balance and seasonality of evapotranspiration in a Bornean tropical rainforest. Agric. For. Meteorol., 128: 81–92