Water balance analysis for Roleang Chrey Irrigation Scheme in Prek Thnot River Watershed, Cambodia

カンボジア・プレックタノート 川流域におけるロリアンチレイ灌漑スキームのための水収支分析

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Introduction

Prek Thnot River is one of major tributaries of Mekong River in Cambodia, whose watershed has high potential in water resources development to increase agricultural production (**Fig.1**). This watershed has an area of 5,000 km^2. Roleang Chrey irrigation scheme is the largest scheme serving a total of 7,662 ha in rainy season and 500 ha in dry season in the watershed. Single-cropped rice predominates in this scheme during the wet season. The rice yield under cultivate areas varies from village to village, from local variety to high yield variety and from year to year. The rice production is still low due to lack of irrigation water, soil type. It shows that this irrigation scheme was not planned properly. Hence, an estimation of irrigation water requirement in the watershed is necessary. In this report, water balance of the paddy field is examined.

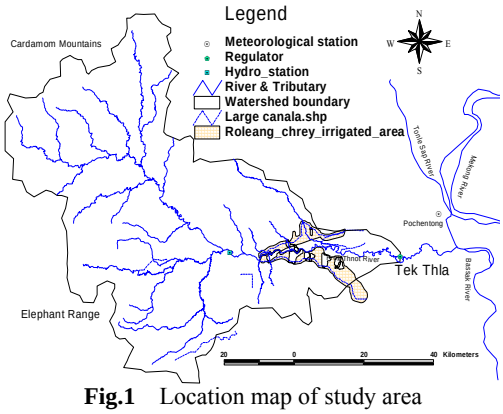

Fig.1 Location map of study area

Available data

Available hydro-meteorological data for this study are summarized in Table 1.

Table 1 Available data

No	Data	Description	Sources
1	Meteo_data (2001-2006)	At Pochentong station, Phnom Penh	Meteorological Department
2	Rainfall data (2001-2006)	11 stations within & near Prek Thnot watershed	Provincial Dept. of Kampong Speu
3	Water level (2004-2006)	4 places along two main canals	Provincial Dept. of Kampong Speu
4	GIS data	Land use, irrigation boundary, soil type	Min. of Public Work & Trans.
5	Agricultural statistic	Cropping pattern	Interview with village chifs

Water Balance of Paddy Field

The water balance equation in the paddy field express the change in the amount of water storage in a control volume during a defined time period as equal to the amount of water entering the volume during the time period, the inflow, minus the amount leaving the volume during that time period, outflow. The equation of water balance of paddy field is written as below

$$\Delta D + \Delta W = (P + IR + S_{in} + R_{in}) - (ETc + I + S_{out} + R_{out}) \quad (1)$$

where, D is ponded water depth, W is soil moisture, P rainfall, IR is irrigation, S_{in} is seepage inflow, R_{in}

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Keywords: Water balance, Irrigation water requirement, Cambodia

surface runoff inflow, *ETc* is crop evapotranspiration, *I* is percolation, S_{out} is seepage outflow, R_{out} is surface runoff outflow. All term in the water balance equation are express in cubic meter. In this case seepage is negligible since the slope of irrigation area is gentle.

Crop evapotranspiration (ETc)

In order to evaluate consumption use of water in the paddy field, the crop ET is one of the most important factors. The *ETc* is estimated from the potential *ET* using the FAO Penman-Monteith method.

Effective Rainfall (*Pe*)

Effective rainfall is based on historical rainfall data that can contribute to the crop water requirement for growing rice in the paddy field. The condition criteria for effective rainfall are followed by

$$\begin{aligned} &1.\ Pe=0.6*P-10 && \text{if } P<75 \text{ mm/month} \\ &2.\ Pe=0.8*P-25 && \text{if } P>75 \text{ mm/month} \end{aligned} \qquad (2)$$

where, *Pe* is effective rainfall (mm/month), *P* is direct average rainfall (mm/month).

Net Irrigation Water Requirement (NIWR)

Based on the effective rainfall, crop evapotranspiration, percolation rate and land preparation, the net irrigation water requirement (NIWR) is express by equation:

$$NIWR = ETc + I + LP - Pe \qquad (3)$$

where, *NIWR* is net irrigation water requirement (mm), I is percolation rate (mm), *LP* is land preparation (mm). In this case, the percolation rate is determined at 8mm/day and the water requirement for land preparation is assume at 120 mm (Nippon Koei Co., Ltd, 2007).

Gross Irrigation Water requirement

Gross Irrigation water requirement (*IWR*) is estimated from net irrigation water requirement. The irrigation water requirement is calculated by the following equation:

$$IWR = NIWR*A*(1/Ef) \qquad (4)$$

where, *IWR* is irrigation water requirement (MCM), *NIWR* is net irrigation water requirement (mm), *A* is planting area (ha), *Ef* is irrigation efficiency. In this case, the overall efficiency is assumed 0.66.

Result and discussion

The monthly average daily potential ET was computed based on meteorological data at Pochentong station from 2001 to 2006 (**Fig.2**). Average daily *ETo* is found 4.9mm/day.

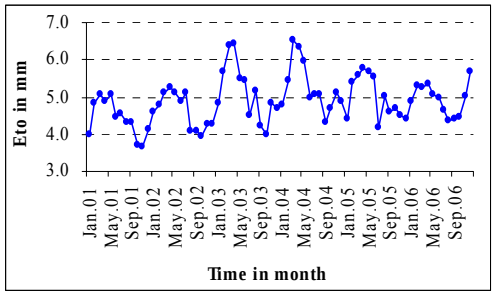

Fig.2 Computed potential

Future Plan

First to compute irrigation water requirement and water balance and then an irrigation sub-model based on water balance together with GIS will be employed for simulating the effect of irrigation activities.

References

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