

## Investigation data analysis for rice crop production model in watershed scale Study case: Singkarak-Ombilin river basin, West Sumatera, Indonesia

### 流域レベルにおけるコメ生産モデルのための調査データの分析

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#### **1. Introduction**

Population growth insist the increasing of food production. Indonesia is an agricultural country that majority of the people consumed rice as a staple food. West Sumatera is a province of rice production center in Indonesia. But the average yield in West Sumatera is comparatively lower around 4.9 ton/ha, where West Java as the highest producer of rice is around 5.9 ton/ha.

The central rice production in West Sumatera located in Singkarak-Ombilin river basin. Ombilin River is an outlet of Singkarak Lake. Due to water diversion for power generation by Singkarak HEPP in 1997, the outflow from Singkarak Lake to Ombilin River was decreased from 49 m<sup>3</sup>/s to 2-6 m<sup>3</sup>/s (Helmi, 2003). This decreasing water table in the river damaged irrigation scheme along the river side farmers, because they conducted traditionally waterwheel operation in irrigation. The irrigated area decreased from 549 to 333 ha and rice production from 4.2 to 3.1 ton/ha (Helmi, 2003).

It is needed to change the irrigation scheme from the traditional way to modernized one, and the current condition of water balance and rice yield in paddy should be analyzed. Therefore, the objectives of this research is to analyze rice production condition in this area by combining rice production model and irrigation availability from estimation of hydrological model.

#### **2. Methodology**

Climatology and hydrological data have been collected to analyze water availability and crop production. Rainfall data is collected from 7 rainfall station. Climatology data such as temperature, wind velocity, humidity, solar radiation and evaporation have been collected from 6 climatology station. Discharge is collected from gauge stations in each river in Singkarak-Ombilin river basin. Water availability is calculated by using water balance approach. To estimate water balance, monitoring data in the watershed is applied. Also, to evaluate field scale model, water balance in paddy filed is estimated.

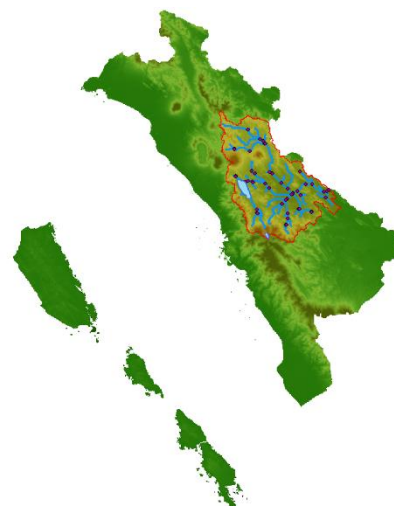


Fig.1 Study area

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Crop production is determined by several factors such as water, seed, fertilizer, soil and etc. These factors are formulated in mathematical models to simulate crop production on field and basin level. There are several models such as Agricultural Policy/Environmental eXtender Model (APEX) that simulates actual growth constrained by stresses (water, temperature, nutrients, and aeration). In this area, irrigation in dry season would be mitigated water stress, however, fertilizer and pest control are important factors. In APEX model, those condition would be evaluated respectively.

### 3. Results and Discussion

Based on collected data analysis, the annual rainfall in Ombilin River basin is around 2769 mm with maximum rainfall around 201 mm/day and minimum rainfall around 1 mm/day. The graphic showed the discharge relatively increased in 2012 around 55.7 m<sup>3</sup>/s with the extreme flow around 685 m<sup>3</sup>/s. The average discharge of Ombilin River is around 26.9 m<sup>3</sup>/s. or 761 mm/year. So the surface water in Ombilin river basin is around 27 % of the rainfall. The average potential evaporation is around 4.38 mm/day or 1604 mm/year, maximum potential evaporation around 8 mm/day and minimum around 1 mm/day.

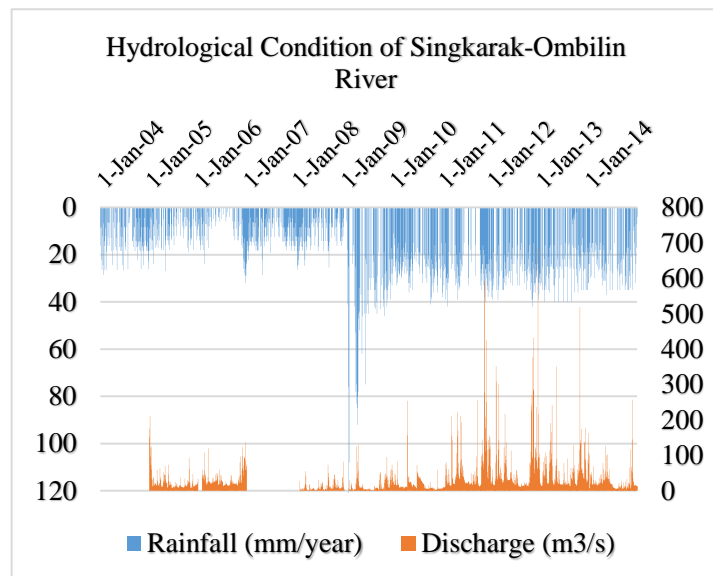


Fig.2 Rainfall and Discharge Trend of Singkarak-Ombilin River Basin

Administratively, Singkarak-Ombilin river basin located in Solok, Tanah Datar, and Sawah Lunto Sijunjung Regencies. The highest yield is in Tanah Datar around 5.6 ton/ha and the lowest is Sawah Lunto Sijunjung around 5.0 ton/ha. Around 70 % of population in Tanah Datar Regency is working in agricultural sector and Sawah Lunto Sijunjung in the downstream of the basin is one of mining town in West Sumatera Province. The upstream primarily hilly area and the downstream relatively flat. Through proper and modernized irrigation infrastructure such as pump irrigation, efficiency can be improved rice production. APEX model is expected to analyze the relationship between rice production and water demand, and it will reveal an optimized water management and agricultural practice under river water level is quite fluctuated by enforced withdrawal of hydropower.

### References

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