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Coping With Water Issues in Ungauged Lower Kapuas River Basin Based on Stakeholders' Attitude

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River water has significant role in Indonesia especially for domestic use, irrigation, aquaculture, economic activities and transportation. Kapuas River as the longest river basin in Indonesia has suffered from extreme precipitation changing that leads to massive flood and severe drought. Aldian and Susanto [1)] reported water deficit due to long drought occurred in many islands in Indonesia including Kalimantan. Indonesian government is still struggling to provide clean water for human consumption, and adequate water supply for industry and agriculture.

Kapuas River runs through several regencies and cities from upstream to downstream in West Kalimantan province. However, every regencies and cities do not have good communication and coordination in regards to water resources management in Kapuas River which leads to conflict of water availability between upstream and downstream, also among stakeholders in downstream. Lukas *et al*[2)] identified '*the conflict-laden multi-functionality of water*' in Kapuas River due to utilizations in upstream and downstream. Therefore, several strategic alternatives are needed to solve water management and hydrology problems in Kapuas River Basin.

The development of strategic alternatives requires basic information of the river. Moreover, the effectiveness of alternatives needs to be estimated by developing model tools. In order to supports stakeholders with making decision in water management activities, the objective of this study are to identify the major problem for water resources management system in the lower Kapuas to develop strategic alternatives to solve the major problems.

The study area locates in the lower of Kapuas with total catchment area 35,195 Km^2. The lower Kapuas has estuary in the region of Pontianak city and Kubu Raya regency. In order to provide daily observational data for hydrology and meteorology data, there are 11 hydrological stations and 6 meteorological stations in Kapuas River basin as shown in **Fig 1**. Limited meteorological station is a challenge to generate hydrological model in a large river basin. Therefore, satellite rainfall estimate (SRE) data have an important role as input to hydrological models in ungauged river basins.

An attempt were made to identify the major problem for water resources management in the lower Kapuas through Focus Group Discussion and Stakeholder Meeting with representatives from different sectors such as government, public enterprise, civil society, NGO and academia.

Qualitative and quantitative data were collected through focus group discussion and semi-structure interview through questionnaire.

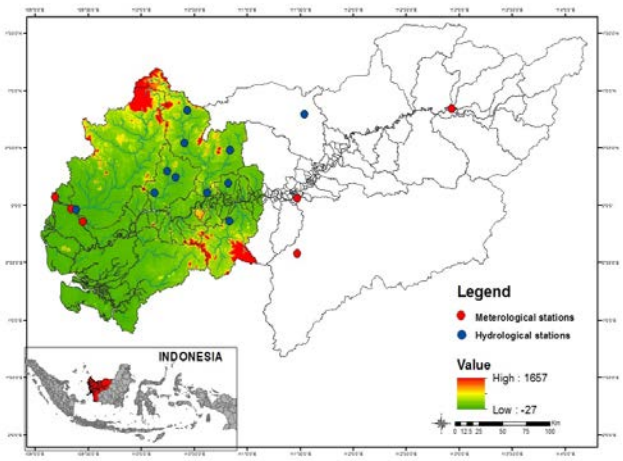

Fig 1. Study area in lower Kapuas with hydrological and Meteorological stations

All stakeholders agreed salt water intrusion is the most priority issue in lower Kapuas following with water supply, water-related disaster, water quality and climate change. The analysis of stakeholders' attitude showed government and public enterprise have strongly supportive attitude regarding their strong power or influence on water resources.

In order to obtain basic hydrology data in ungauged catchment of Kapuas, this research develops analysis model through IFAS model. IFAS is a hydrological model to calculate river discharge by using global GIS database and satellite-based rainfall or ground rainfall. The 1-km mesh model was set-up with parameters on 3-layer tank model including surface, subsurface, aquifer and river course tank. Sekayam River as a tributary of Kapuas River was selected to check model performance. Sekayam river is located at the most upstream of lower Kapuas. There are three hydrology stations in Sekayam River: Balai karangan Station, Kembayan Station and Balai Sebut Station.

Due to less meteorology station in the study area, the satellite-based rainfall estimates derived from TMPA 3B42RT (V6) (NASA product) and GSMaP-NRT (Global Satellite Mapping of Precipitation, Near Real-Time product by JAXA) were used and compared to the case of ground observation.

IFAS model used global dataset such as DEM from GTOPO30, land use from GLCC, soil type from FAO as input data to generate sub basin, river course, surface parameter and river course parameter of the study area (see **Fig. 2**).

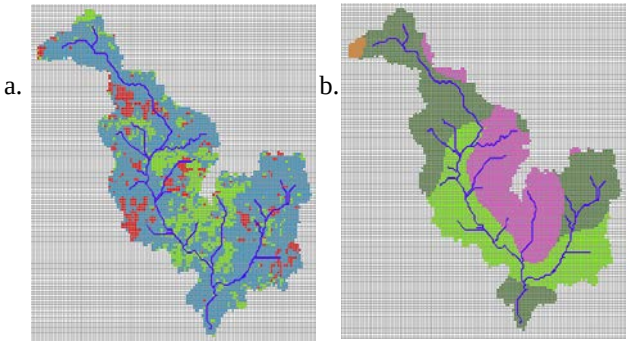

Fig 2. Model parameters a).surface parameter with land use data, b) subsurface parameter with soil type data

A drought event in 2009 was selected to compare satellite rainfall estimate (SRE) and ground rainfall stations. The initial simulated discharge from TMPA 3B42RT was able to follow the wave shape and trend of observed discharge, but the magnitude of the peak higher than observed discharge. The simulated discharge by GSMaP_NRT was not synchronized on shape of wave, trend as well as magnitude of the peak. The simulation result generated from TMPA 3B42RT was over-estimated compare with observed discharge. The result of initial simulation showed higher magnitude of peak and base flow for simulated discharge. Therefore, the calibration process was conducted on the parameters value in the surface and aquifer tank. The calibration on surface was performed on the infiltration capacity, maximum storage height and rapid intermediate flow. The discharge simulation with tuned parameters was able to reduce error on peak discharge and baseflow (see **Fig 3**). The calibration of model in surface and aquifer tank gives better result on peak, volume and wave shape of simulated discharge.

References

1. Aldian.E.,Susanto.R.D. Identification of three dominant rainfall regions within Indonesia and their relationship to sea surface temperature. *Int.J.Climatol*.23:1435-1452.2003.
2. Lukas, M. C., Julia, radjawali, i., flitner, M., Pye, O. The Conflict-Laden Multi-functionality of the Kapuas river in Kalimantan, indonesia. ASEAS - Austrian Journal of South-East Asian Studies, 5(2), 359-368.2012.

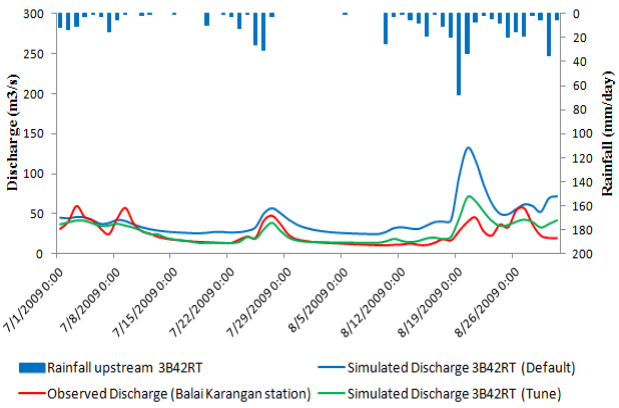

Fig 3. Hydrograph of 3B42RT (original) with default and tune parameters in Balai Karangan station in 2009