

Fundamental Study on Water Related Risk in Kalimantan Island Indonesia

Toyama Prefectural University Student Member ○Shelvy E. Santoso

Toyama Prefectural University Regular Member Tebakari Taichi

Toyama Prefectural University Regular Member Kure Shuichi

Indonesian Ministry for Public Works Regular Member Idham Riyando Moe

Bandung Institute of Technology Regular Member Mohammad Farid

1. BACKGROUND

Indonesian current capital city, Jakarta is always flooded with water during rainy season. The Indonesian government is going to move the Indonesian capital city into another place in Kalimantan Island. This study will present a comprehensive analysis on assessing the newly appointed capital city using Integrated Flood Analysis Software (IFAS) as well as creating hazard map using remote sensing approach. The outcome analysis of this study is suggesting the appointed capital city is a suitable place considering the highest hydrograph output value is relative lower than the flood discharge based on the IFAS simulation.

2. STUDY AREA

The study area of this research is located in Mahakam River, Kutai Kartanegara City, Indonesia which located 68.5 km away from Samarinda the capital city of East Kalimantan. Fig.1 shows the map of study area. The area of the study is around 26,934.97 km² covering 22 districts and 291 villages.

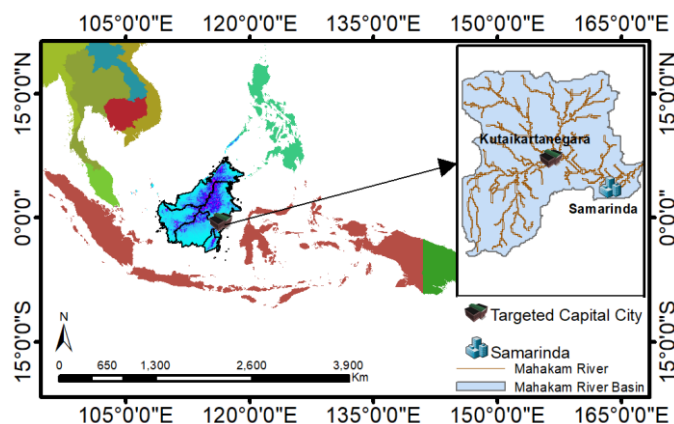


Fig. 1 Study Area

3. DATA

This study using various different data sets approach from remote-sensing to government-based data for precipitation and water related aspect.

3.1 IFAS Data Input

Table 1 further described IFAS data input along with its data

provider and resolution.

Table 1 Precipitation Data Sets

Data Items	Provider	Spatial Resolution	Temporal Resolution
Precipitation (mm/hr)	TRMM 3B42RT	28 km	24 hours
Precipitation (mm/hr)	BMKG*	-	24 hours

3.2 Water Related Risk Data Input

Table 2 further described the water related data set along with its detail.

Table 2 Water Related Data Sets

Data Items	Provider	Year	Resolution
Drinking Water Coverage	BPS*	2015	-
Ground Water Availability	Bakosurtanal*	2008	-
Topography	DEM Merit	2017	90 m
Drought Hazard Map	BNPB*	2011	-
Land-use	WRI*	2017	2.5 km

* Indonesian Meteorological, Climatological, and Geophysical Agency

* BPS (Indonesia Statistical Agency)

* Bakosurtanal (Indonesian Geological Agency)

* BNPB (Indonesian National Board for Disaster Management)

* WRI (World Research Institute)

4. METHODOLOGY

The Integrated Flood Analysis System (IFAS) is a toolkit for more effective and efficient flood forecasting which incorporates the GIS features to perform a rainfall-runoff model [1]. The IFAS model operates a modified bucket model as the basis modelling. This model accommodates the configuration of two buckets (surface and underground) in the vertical direction and a third bucket in the horizontal direction in the form of river channel [2].

Keywords: Flood Risk Assessment, Hazard Map, IFAS, Numerical Analysis, Remote Sensing.

Contact address: 5180 Kurokawa, Imizu, Toyama 939-0398, Japan, email: t957002@st.pu-toyama.ac.jp

3.1 IFAS Model Setting

- Modelling Setting: 1 km x 1 km grid with hourly time step was set. Global map data for land use and digital elevation modelling (DEM) data were also utilized during the preliminary modelling.

- Precipitation data: daily data were available from 7 ground gauges which are installed and operated by Indonesian Meteorological, Climatological, and Geophysical Agency (BMKG). The TRMM 3B42RT satellite-based data was imported into the model which cover the precipitation data every 28km (0.25°) for 24 hours.

5. OUTCOME

5.1 WATER RELATED RISK OUTCOME

The targeted capital city is also assessed using water related risk approach. **Fig. 4, 5, 6** further described the water related risk.

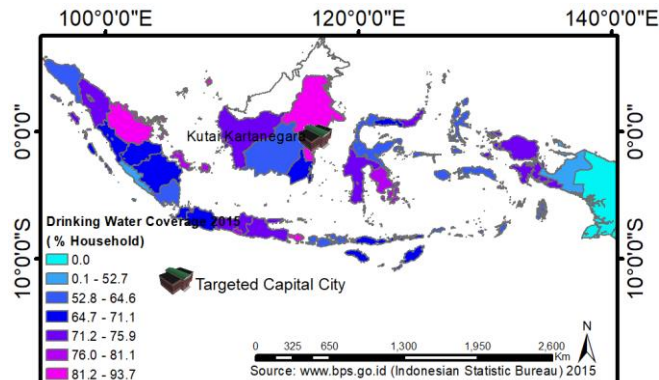


Fig. 4 Drinking Water Availability

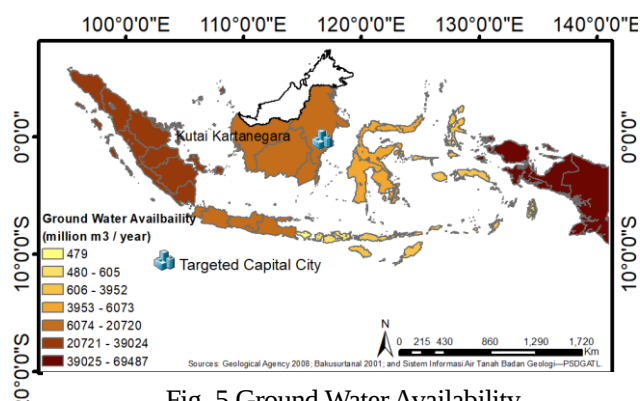


Fig. 5 Ground Water Availability

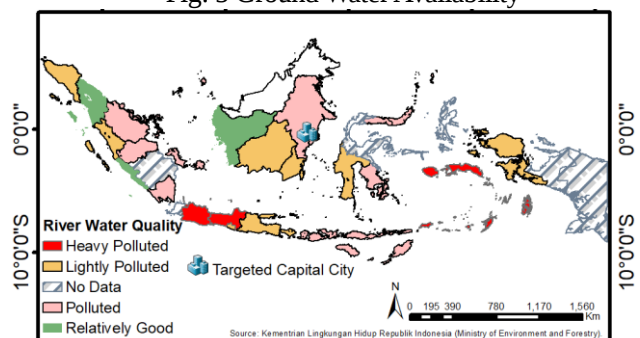


Fig. 6 River Water Quality

5.2 FLOOD RISK ANALYSIS OUTCOME

Flood risk analysis in this study was done using IFAS Software, the result of the IFAS hydrograph output can be seen on **Fig. 7** with the detailed result explained on **Table.3**

Table 3 IFAS Outcome

Parameter	Coefficient of slow intermediate outflow	Coefficient of base outflow	R ² Precipitation	R ² Discharge
Default	0.11	0.003	0.35	0.40
Tuned	0.4	0.004	0.59	0.50

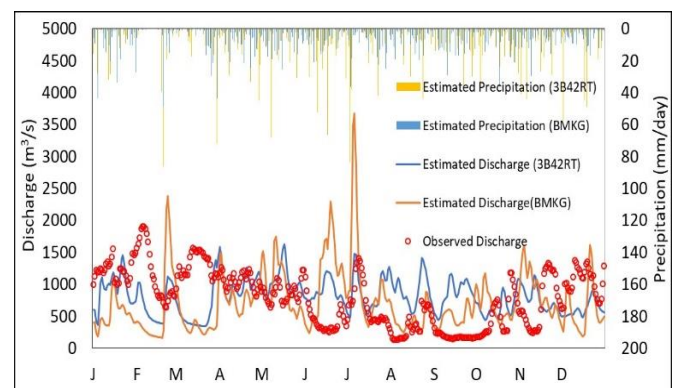


Fig. 7 Output Hydrograph

6. CONCLUSION

The IFAS software can be used to project the flood analysis on the targeted capital city. However applying a different condition during simulation and calibration might also gave inaccurate output. Improving different parameter on the calibration might also not giving a direct and accurate output. Therefore a match between gauged station precipitation data and the remotely-sensed data is an essential things to make sure.

7. REFERENCES

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