Evaluation of GSMaP-NRT for Flood Inundation Modeling in Jakarta, Indonesia

Toyama Prefectural University, JSCE Member, Bambang Adhi PRIYAMBODHO
Toyama Prefectural University, Associate Professor, JSCE Member, Shuichi KURE

1. Introduction

Jakarta has experienced large floods in 1996, 2002, 2007, 2013, and 2014. Flood inundation in Jakarta is mainly caused by heavy rain, especially during the rainy season. In this study, the satellite rainfall product global satellite mapping of precipitation in near real-time (GSMaP-NRT) was assessed, because radar-rainfall prediction was stopped by the Indonesian government in 2013. Furthermore, GSMaP-NRT data is one of the satellite precipitation datasets and is freely distributed via the Internet. This study aims to evaluate the accuracy of the satellite precipitation product GSMaP-NRT for the Ciliwung River Basin in Jakarta, Indonesia.

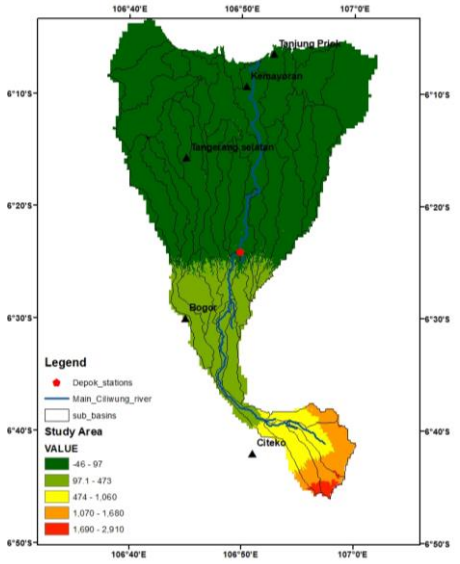

Fig. 1 Study area

2. Study Area

Jakarta is located in West Java, Indonesia. The total area covered in this study is 1,346.6 km^2, which includes the city of Jakarta. There are 13 main rivers flowing through this region, with the Ciliwung River being the longest, as illustrated in **Figure 1**. Additionally, five rainfall stations are located in this study area.

3. Methodology

1) GSMaP data

The GSMaP project was developed in 2002 to provide rainfall rate retrieval algorithms and produce high-resolution global precipitation maps from satellite data[1), 2)]. GSMaP-NRT is distributed by JAXA Global Rainfall Watch[1)].

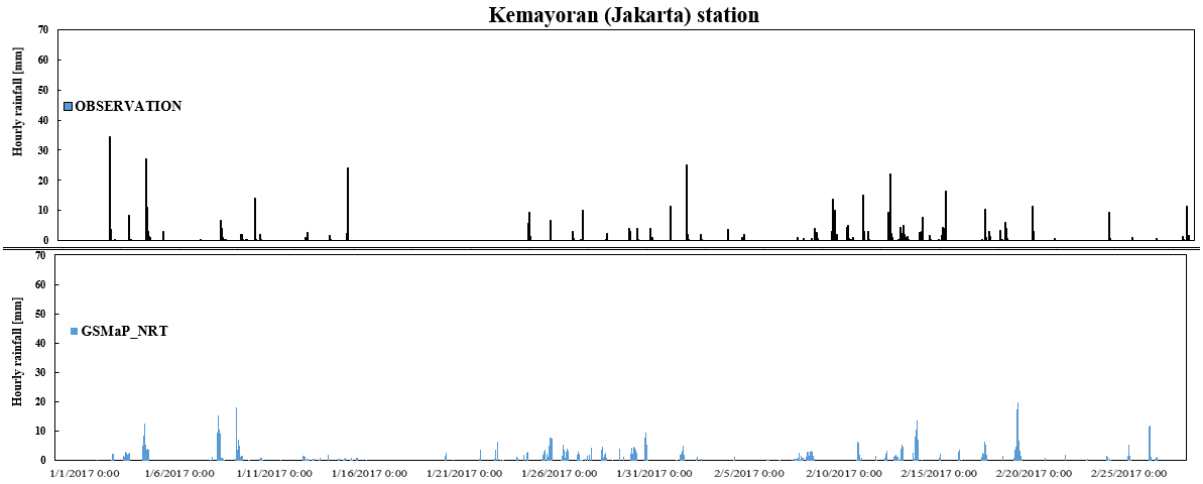

Fig. 2 Comparison of hourly precipitation between the GSMaP-NRT and observation for January and February 2017 at Kemayoran station, Jakarta

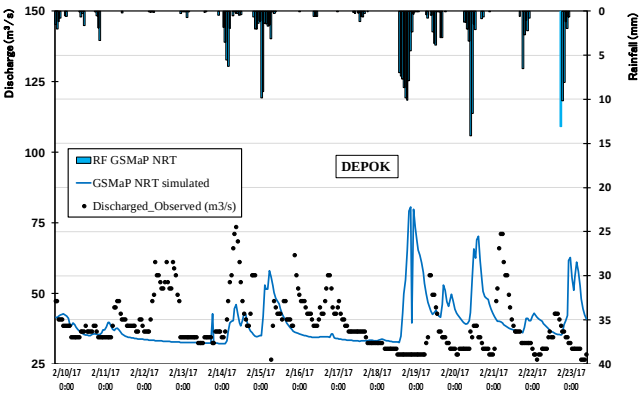

Fig. 3 Simulated and observed hydrographs at Depok station for the 2017 flood event

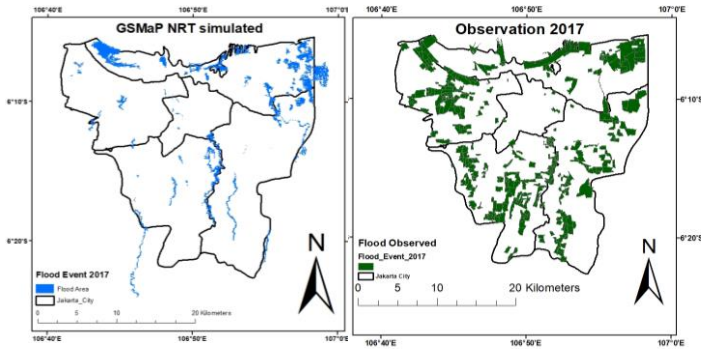

Fig. 4 Simulated GSMaP-NRT (left) and observed (right) data for the 2017 flood event

2) Evaluation index

We used the root mean square error and correlation coefficients as evaluation indexes to assess the satellite precipitation and rain gauge observations.

3) Flood inundation model

We used a flood inundation model to investigate the flood inundation in Jakarta. The model comprises a rainfall-runoff module for each sub-basin, hydrodynamic module for the river and canal networks, and flood inundation module for the floodplains. For the details of the model, see reference[3)].

4. Results and Conclusion

The comparison of the hourly precipitation between the observation and the GSMaP-NRT within the period of January–February 2017 in Kemayoran station in Jakarta is depicted in **Figure 2.** The comparison of the hydrographs between the simulation and observation at Depok station for the 2017 flood event is depicted in **Figure 3.** Additionally, the comparison between the flood inundation simulation and observation for the 2017 flood event is depicted in **Figure 4.** The observation map was provided by the Badan Penanganan Bencana Daerah: Jakarta Disaster Management Agency. According to these results, we conclude that the simulation results are biased when comparing the observation data; therefore, rainfall data from the GSMaP need to be modified based on bias corrections to achieve better performance.

5. References

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2) Ushio, T., and Kachi, M.: A Kalman filter approach to the Global Satellite Mapping of Precipitation (GSMaP) from combined passive microwave and infrared radiometric data: *J. Meteor.Soc*. 87A, 137-151,2009.

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