Assessment of near-real-time satellite-based precipitation over Thailand

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Outline

- Introduction
- Data
- Methodology
- Result & Discussion
- Conclusion

Objectives

- To evaluate satellite-based precipitation products, GSMaP_NRT and PERSIAN-CCS.
- To find how well of satellite-based rainfall products detection, especially in the northern part of Thailand.

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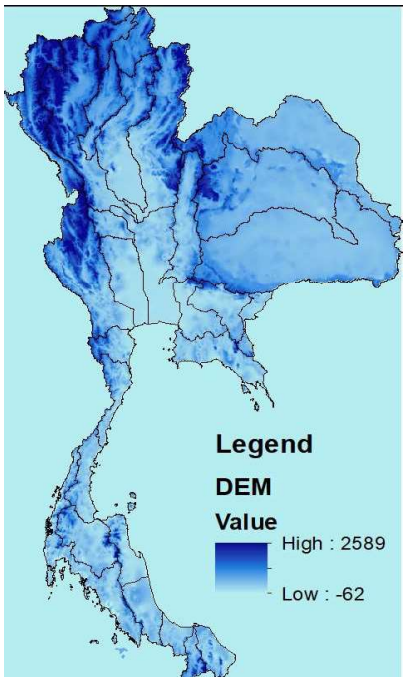

Figure 1. Digital Elevation Model of Thailand

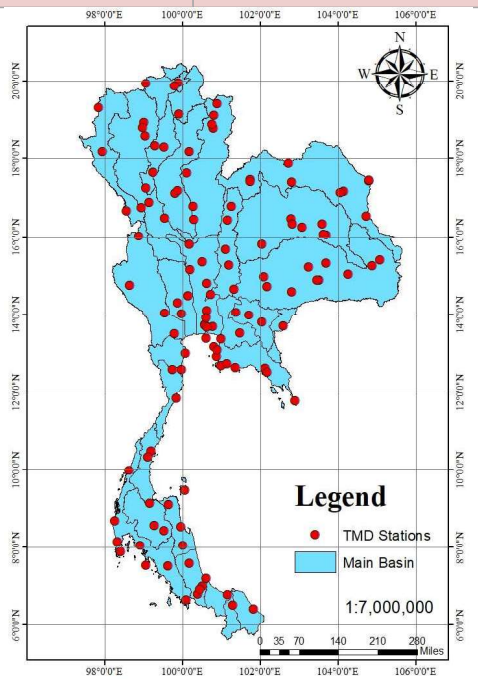

Figure 2. Rain gauge network

Using Thai Meteorology Department rainfall data.

Table 1. The rainfall data

Name	Period	Type	Spatial resolution	Temporal resolution
TMD Station	2009-2013	Point	None	Daily
GSMaP_NRT	2009-2013	Grid	0.1 degree	Hourly
PERSIANN-CCS	2009-2013	Grid	0.04 degree	Hourly

Global Rainfall Map in Near-Real-Time (GSMaP_NRT) and Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networl Cloud Classification System (PERSIANN-CCS) use for evaluation.

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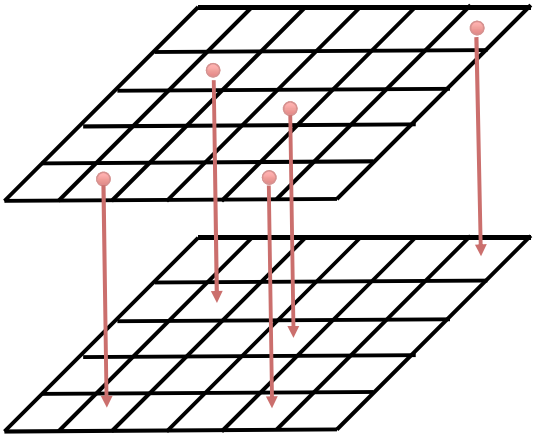

Figure 3. Comparing points data and grid data.

Comparing point data in which the same grid data.

Exploratory Indices

Root mean squared error (RMSE)	Correlation coefficient (R)	Bias of estimation
$RMSE=\sqrt{\frac{\Sigma(X_{obs}-X_{sim})^2}{N}}$	$R=\frac{N\Sigma xy-(\Sigma x)(\Sigma y)}{\sqrt{N(\Sigma x^2)-(\Sigma x)^2}\sqrt{N(\Sigma y^2)-(\Sigma y)^2}}$	bias of estimation= $\frac{1}{N}\sum(X_{obs}-X_{sim})$

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		Observation: Yes	Observation: No	
Satellite	Yes	a	b	a+b
Satellite	No	c	d	c+d
		a+c	b+d	n = a+b+c+d

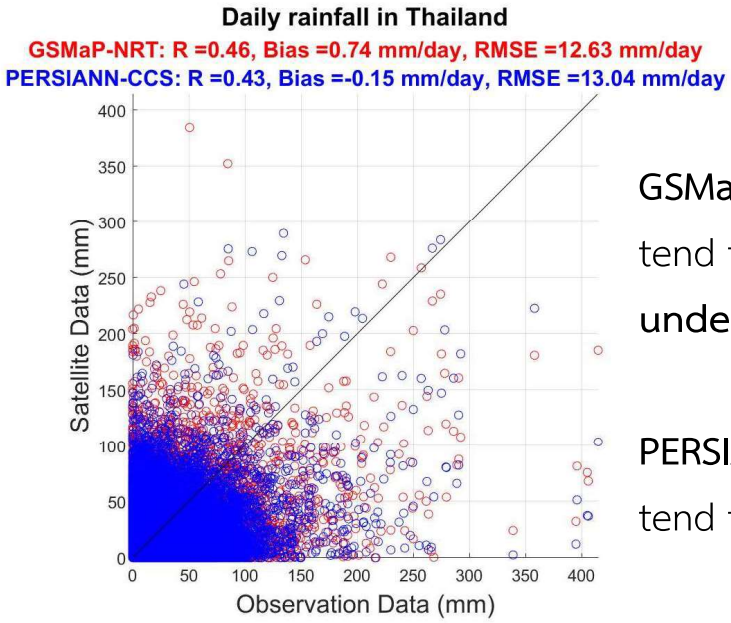
Figure 4. Contingency Table

Ratio of hit data and miss data.

Hit rate: $HR=\frac{a}{a+c}$

Ratio of false alarm data and negative data.

False alarm rate: $FR=\frac{b}{b+d}$



GSMaP_NRT product tend to **underestimate.**

PERSIANN-CCS product tend to **overestimate.**

Figure 5. Scatter plot of daily rainfall over Thailand.

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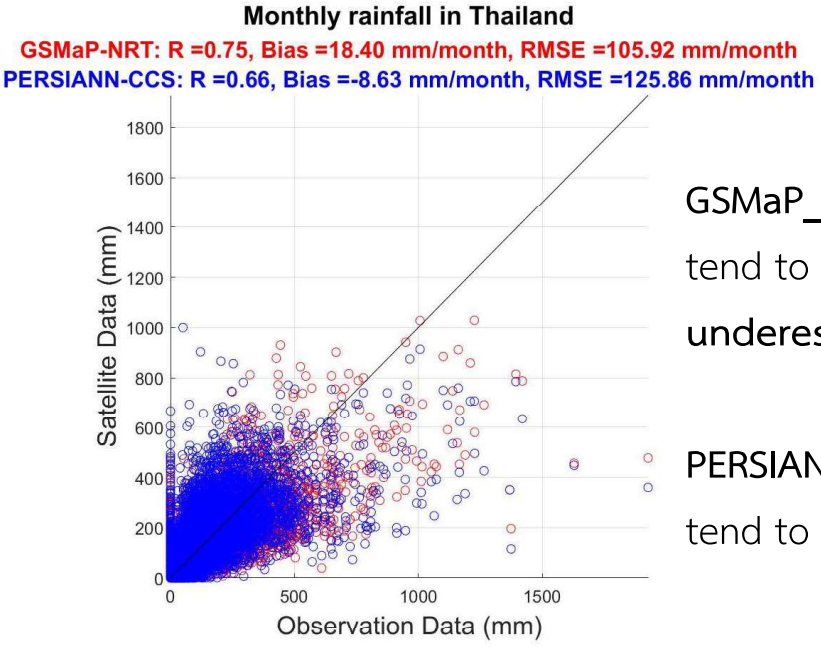
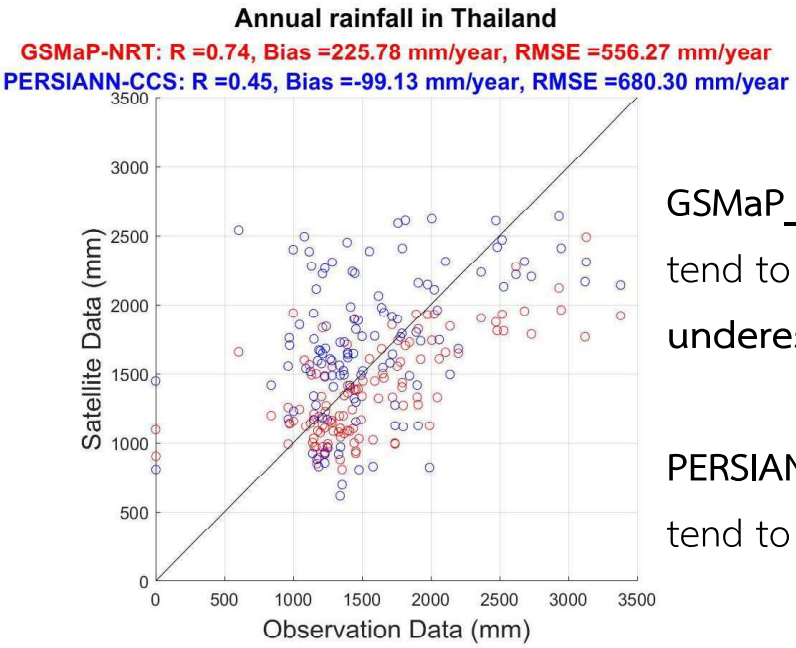


GSMaP_NRT product tend to **underestimate.**

PERSIANN-CCS product tend to **overestimate.**

Figure 6. Scatter plot of monthly rainfall over Thailand.



GSMaP_NRT product tend to **underestimate.**

PERSIANN-CCS product tend to **overestimate.**

Figure 7. Scatter plot of annual rainfall over Thailand.

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Table 2. Summary of Exploratory indices.

	GSMaP_NRT			PERSIANN-CCS		
	R	RMSE	Bias	R	RMSE	Bias
Daily	0.46	0.74 mm./d.	12.63 mm./d.	0.43	-0.15 mm./d.	13.04 mm./d.
Monthly	0.75	18.40 mm./m.	105.82 mm./m	0.66	-8.63 mm./m.	125.86 mm./m.
Annual	0.74	225.78 mm./y.	556.27 mm./y.	0.45	-99.13 mm./y.	680.30 mm./y.

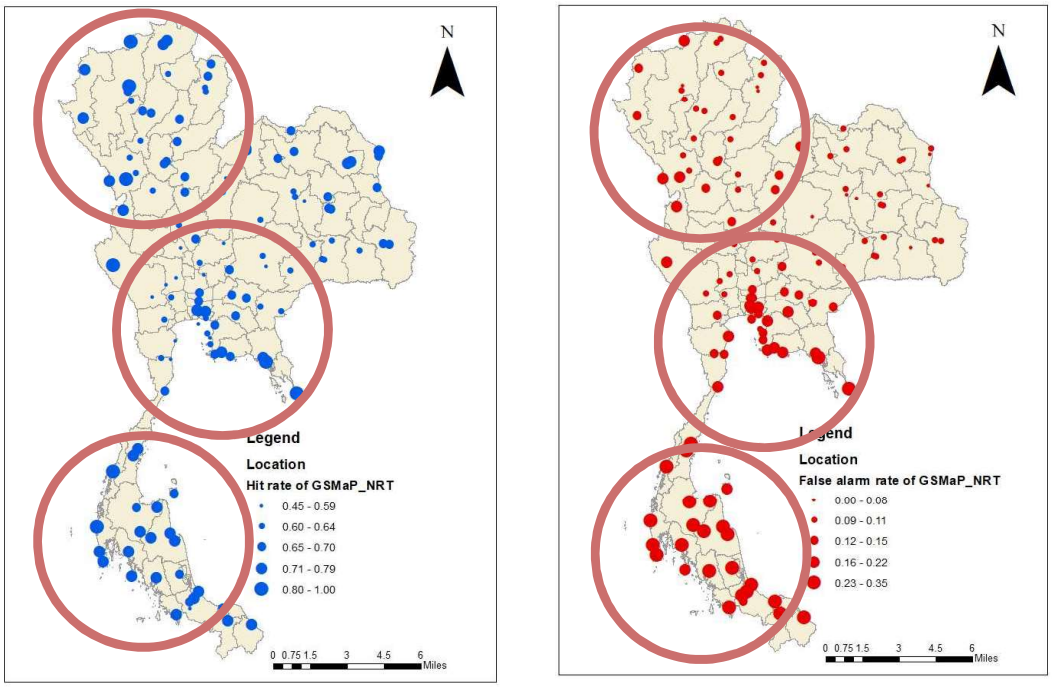

Figure 8. Hit rate and false alarm rate of GSMaP_NRT over Thailand.

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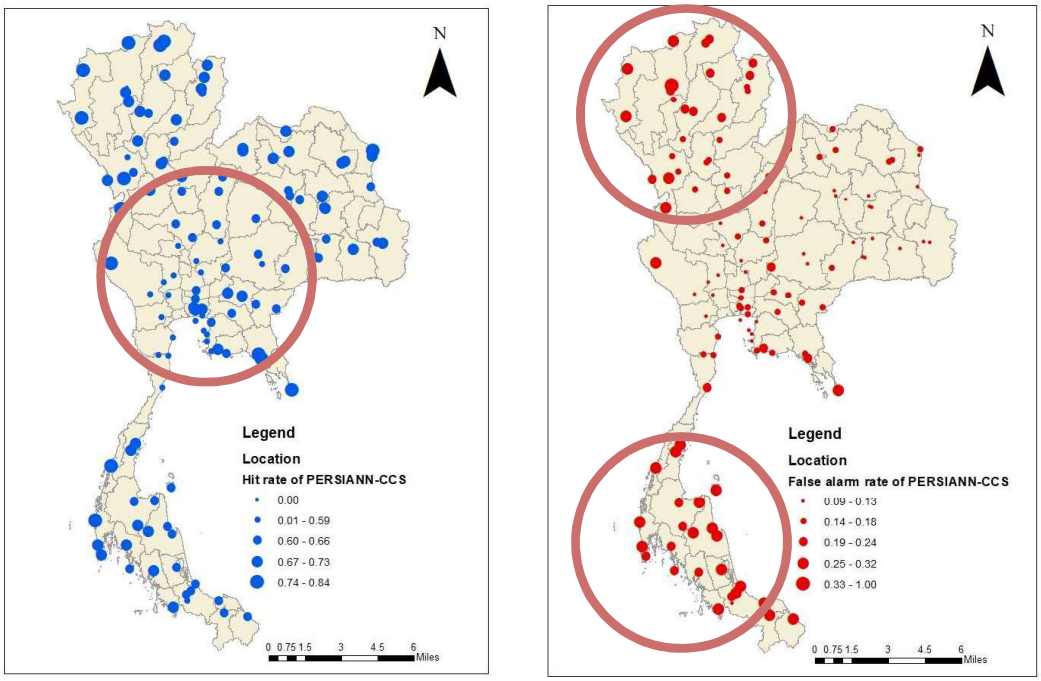

Figure 9. Hit rate and false alarm rate of PERSIANN-CCS over Thailand.

Table 3. The average hit rate and false alarm rate of satellite-based rainfall products

	HR	FR
GSMaP_NRT	0.65	0.18
PERSIANN-CCS	0.67	0.15

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- The two satellite-based rainfall products with the hit rate of 65-67% and the false alarm rate of 15-18%.
- The daily correlation coefficient of 0.43-0.46 and the monthly and annual increase to 0.45-0.75.
- For the annual rainfall greater than 1,000 mm.
- The performance of satellite-based products significantly varies spatially. GSMaP_NRT is relatively better than PERSIANN-CCS.
- Adjustment to reduce bias of the products should be implemented.

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