Attention-Based Deep Fusion CNN for Geostationary Satellite Rainfall Estimates over Taiwan Part 2: Product Evaluation

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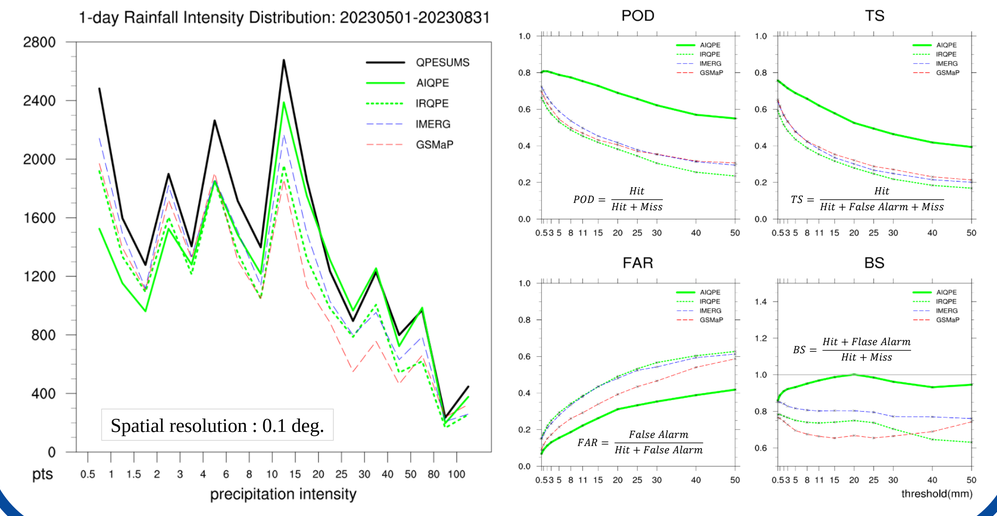
Abstract

A deep leaning model for estimating surface rainfall based on Himawari-8/AHI data (named AIQPE) was developed for Taiwan area (See Part 1 for model details). In Part 2 of this companion poster presents an assessment of AIQPE's performance in summer 2023 by taking a gauge-corrected Radar rainfall product(named QPESUMS) as the ground truth. An IR-based product established by the PDF-matching technique (named IRQPE[1]) and two GPM rainfall products(IMERG[2] Late V6 and GSMaP[3] MVK V8) are also used for the inter-comparison. The results show that AIQPE outperforms other satellite rainfall products at all time scales from daily rainfall to monthly rainfall estimates for Taiwan's land area.

1-day Rainfall Intensity Distribution

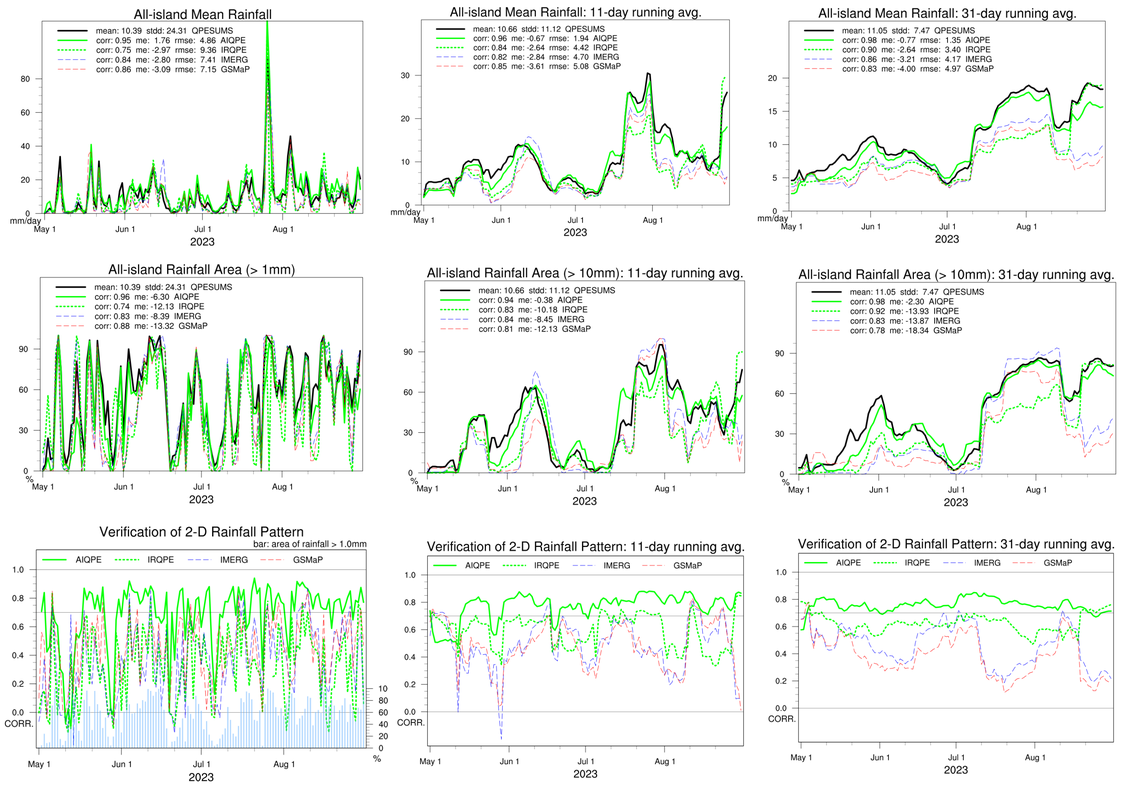


Time scale on 1-day, 11-day and 31-day

G.T. : QPESUMS | Corr. | Mean Bias | Based on : 2023 May - Aug.

All-island value

All-island value	1-day	11-day	31-day
AIQPE	**0.95 | +1.76**	**0.96 | -0.67**	**0.98 | -0.77**
IRQPE	0.75 | -2.97	0.84 | -2.64	0.90 | -2.64
IMERG	0.84 | -2.80	0.82 | -2.84	0.86 | -3.21
GSMaP	0.86 | -3.09	0.85 | -3.61	0.83 | -4.00



Rain Area definition : 1-day > 1 mm ; 11-day&31-day > 10mm

Rain Area(%)

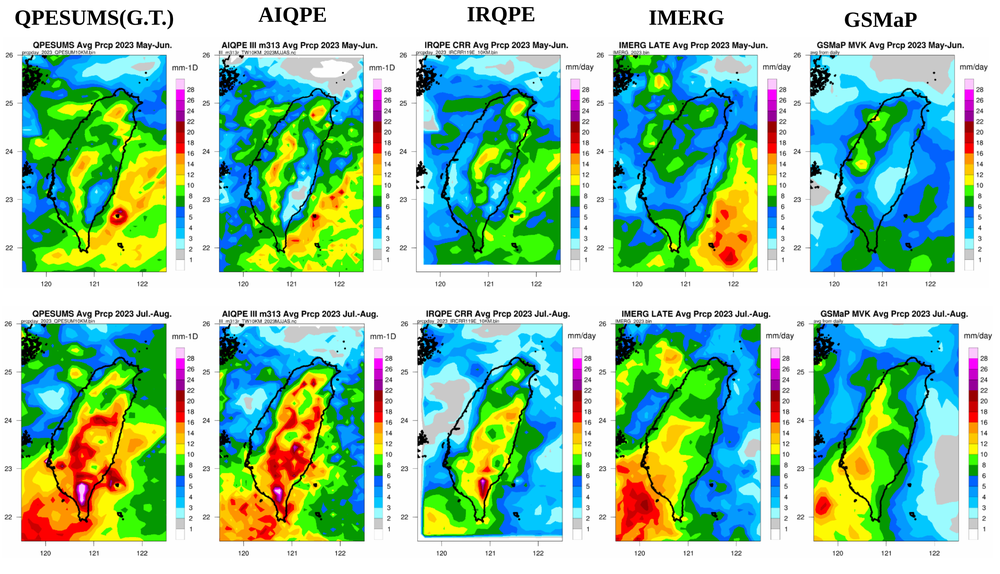
Rain Area	1-day	11-day	31-day
AIQPE	**0.96 | -6.30**	**0.94 | -0.38**	**0.98 | -2.30**
IRQPE	0.74 | -12.13	0.83 | -10.18	0.92 | -13.93
IMERG	0.83 | -8.39	0.84 | -8.45	0.83 | -13.87
GSMaP	0.88 | -13.32	0.81 | -12.13	0.78 | -18.34

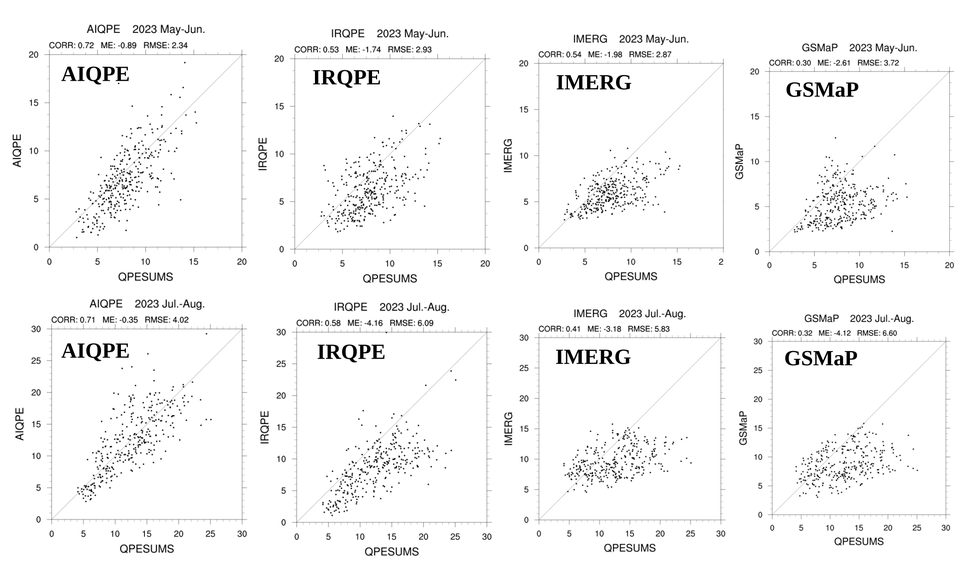
Mean Daily Corr. | Mean Daily RMSE

Rainfall pattern

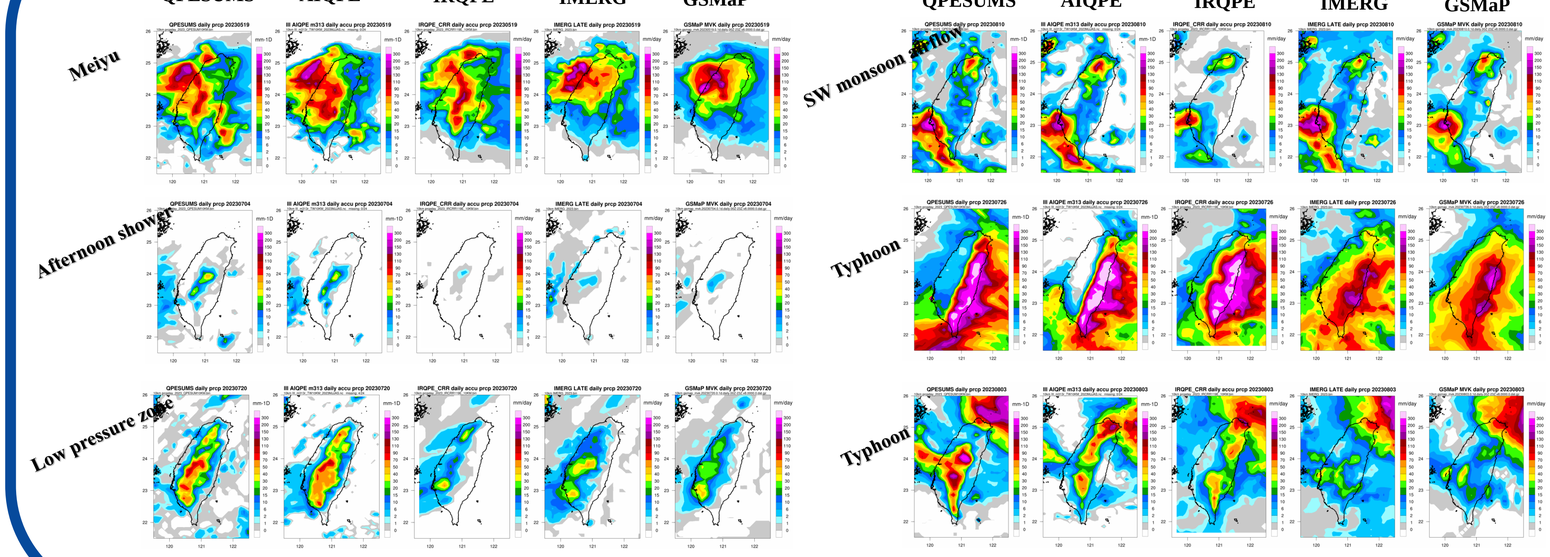
Rainfall pattern	1-day	11-day	31-day
AIQPE	**0.68 | 10.03**	**0.76 | 4.94**	**0.77 | 3.88**
IRQPE	0.32 | 15.12	0.62 | 6.99	0.59 | 5.16
IMERG	0.36 | 14.38	0.48 | 7.61	0.49 | 5.55
GSMaP	0.45 | 14.35	0.39 | 8.03	0.49 | 6.64

Seasonal mean rainfall : Meiyu season and Midsummer season

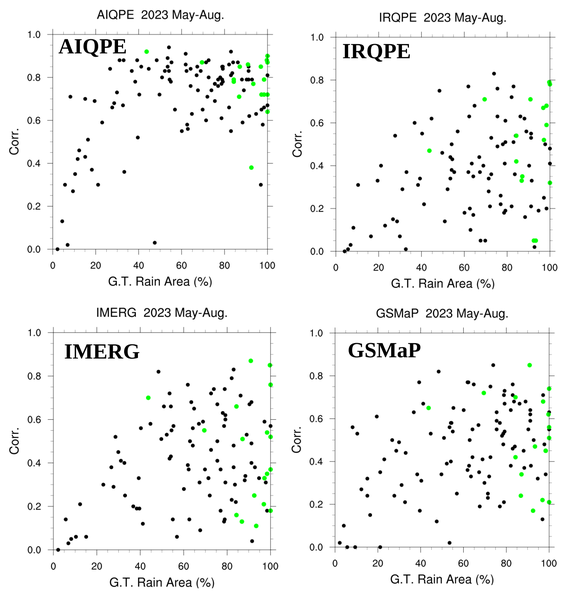




Cases from a variety of weather types (1-day rainfall)



Rain Area(%) vs Corr. with G.T.



Green dots : G.T. daily mean rainfall > 20mm

Reference & Data Credit

[1] Chen, Y.-L.; Chen, C.-R.; Xie, P. Geostationary Precipitation Estimates by PDF Matching Technique over the Asia-Pacific and its Improvement by Incorporating with Surface Data. Atmosphere 2023, 14(2), 342. https://doi.org/10.3390/atmos14020342.
[2] Huffman, G. J., and Coauthors, 2020: Integrated multi-satellite retrievals for the Global Precipitation Measurement (GPM) mission (IMERG). Satellite Precipitation Measurement, Springer, 343–353, https://doi.org/10.1007/978-3-030-24568-9_19.
[3] Kubota, T., K. Aonashi, T. Ushio, S. Shige, Y. N. Takayabu, M. Kachi, Y. Arai, T. Tashima, T. Masaki, N. Kawamoto, T. Mega, M. K. Yamamoto, A. Hamada, M. Yamaji, G. Liu and R. Oki 2020: Global Satellite Mapping of Precipitation (GSMaP) products in the GPM era, Satellite precipitation measurement, Springer, https://doi.org/10.1007/978-3-030-24568-9_20.

Data Credit: GSMaP(JAXA), IMERG(NASA), Himawari-8(JMA), QPESUMS(CWA)