Session: AS1.13 Precipitation: Measurement, Climatology, Remote Sensing, and Modelling

Performance evaluation of GPM IMERG precipitation over the tropical oceans

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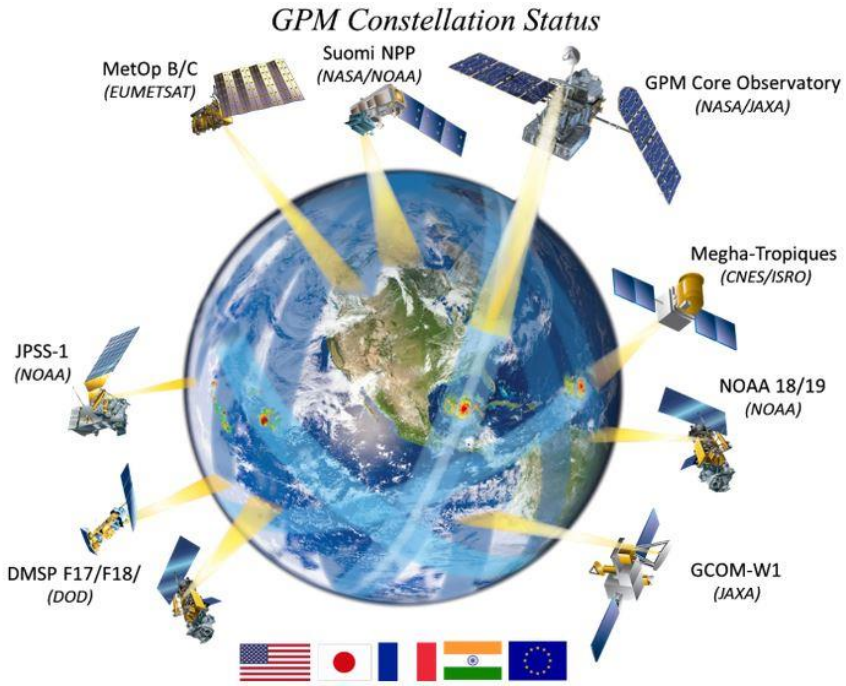
Background



source: https://gpm.nasa.gov/gpm

- GPM core satellite was Launched on 28th February 2014.
- Integrated Multi-Satellite Retrievals for GPM (IMERG) an Multisatellite estimate.
- There has been little information regarding the performance of GPM's IMERG on the global ocean [1, 2].

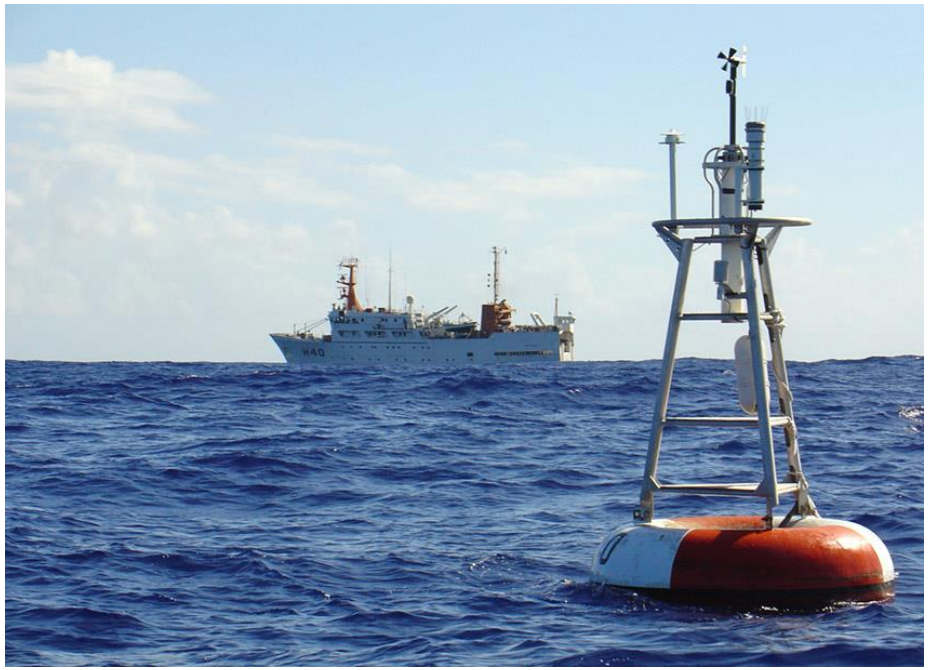
Objective

- Quantitative assessment of the GPM's IMERG precipitation products on over the tropical ocean.

Data

Study area and period:

- 25˚ N - S in both the hemisphere.
- 2001 - 2020



source:https://www.pmel.noaa.gov/gtmba/

Name	Spatial scale	Temporal scale	Record length	References
IMERG-E, -L, -F	0.1˚ × 0.1˚	daily	2001 - 2020	[3]
Buoys	point	daily	2001 – 2020	[4, 5]

Methods

$$Bias = \frac{\sum(S_i - G_i)}{N}$$

$$MAE = \frac{\sum|S_i - G_i|}{N}$$

$$RMSE = \sqrt{\frac{\sum(Si - G_i)^2}{N}}$$

$$r = \frac{\left(\Sigma(S_i - \bar{S})(G_i - \bar{G})\right)^2}{(\Sigma(S_i - \bar{S})^2 \Sigma(G_i - \bar{G})^2)}$$

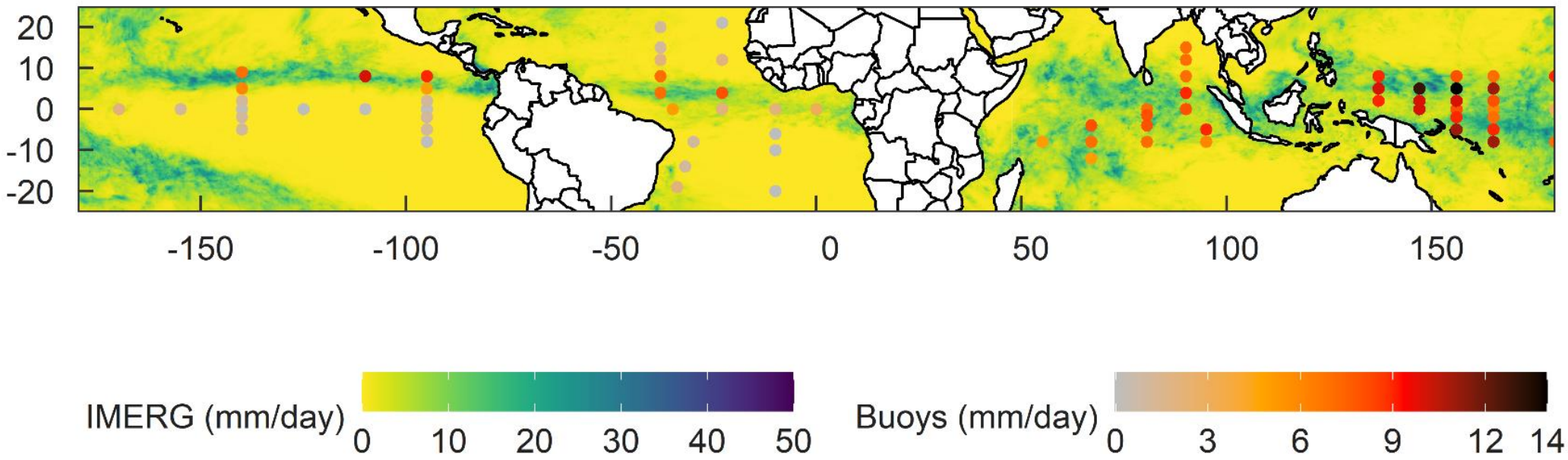
	Gauge ≥ Threshold	Gauge < Threshold
Satellite ≥ Threshold	Hits (H)	False alarms (F)
Satellite < Threshold	Misses (M)	Correct negative (C)

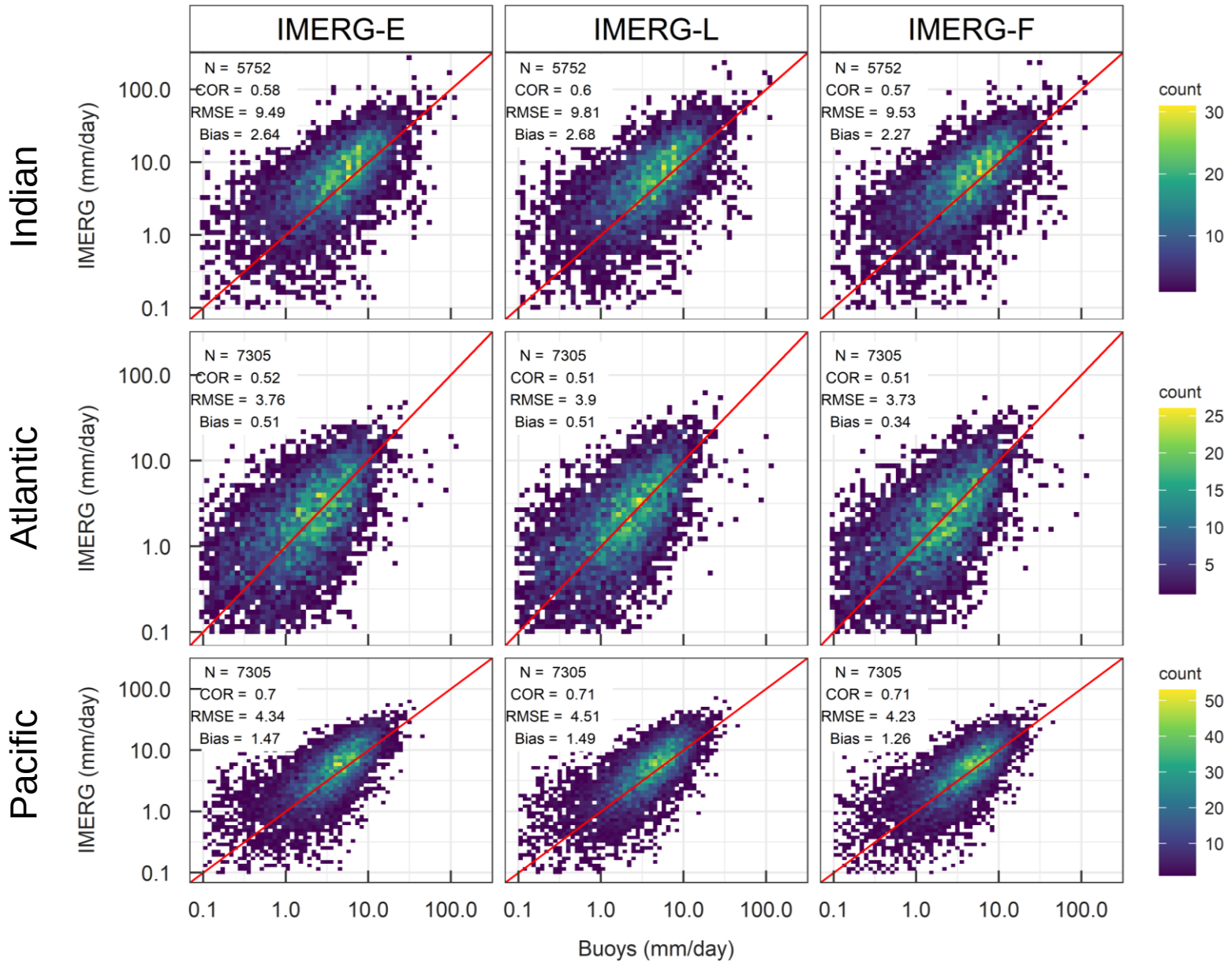
$$POD = \frac{H}{H + M}$$

$$FAR = \frac{F}{H + F}$$

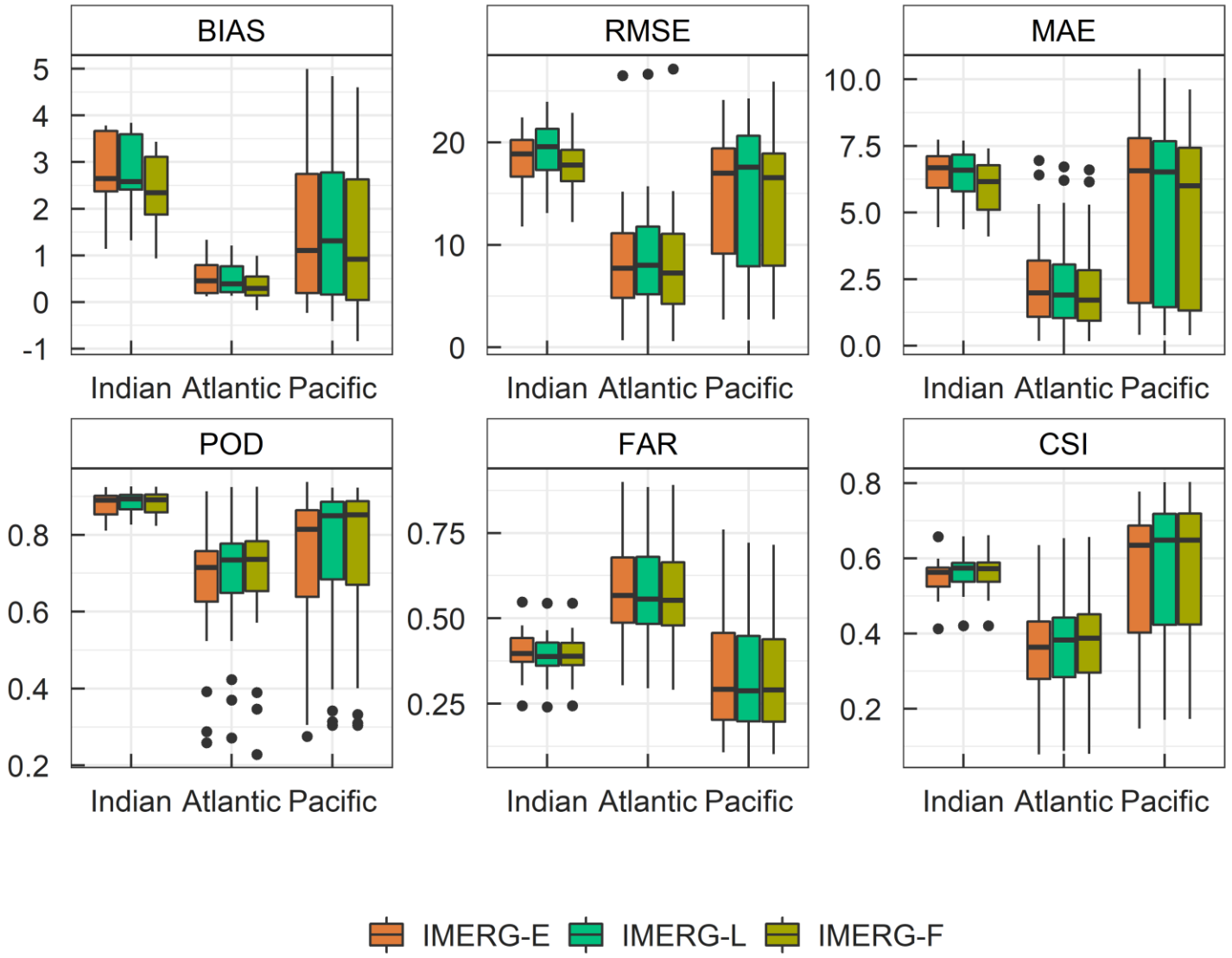
$$CSI = \frac{H}{H + M + F}$$

Spatial mean precipitation

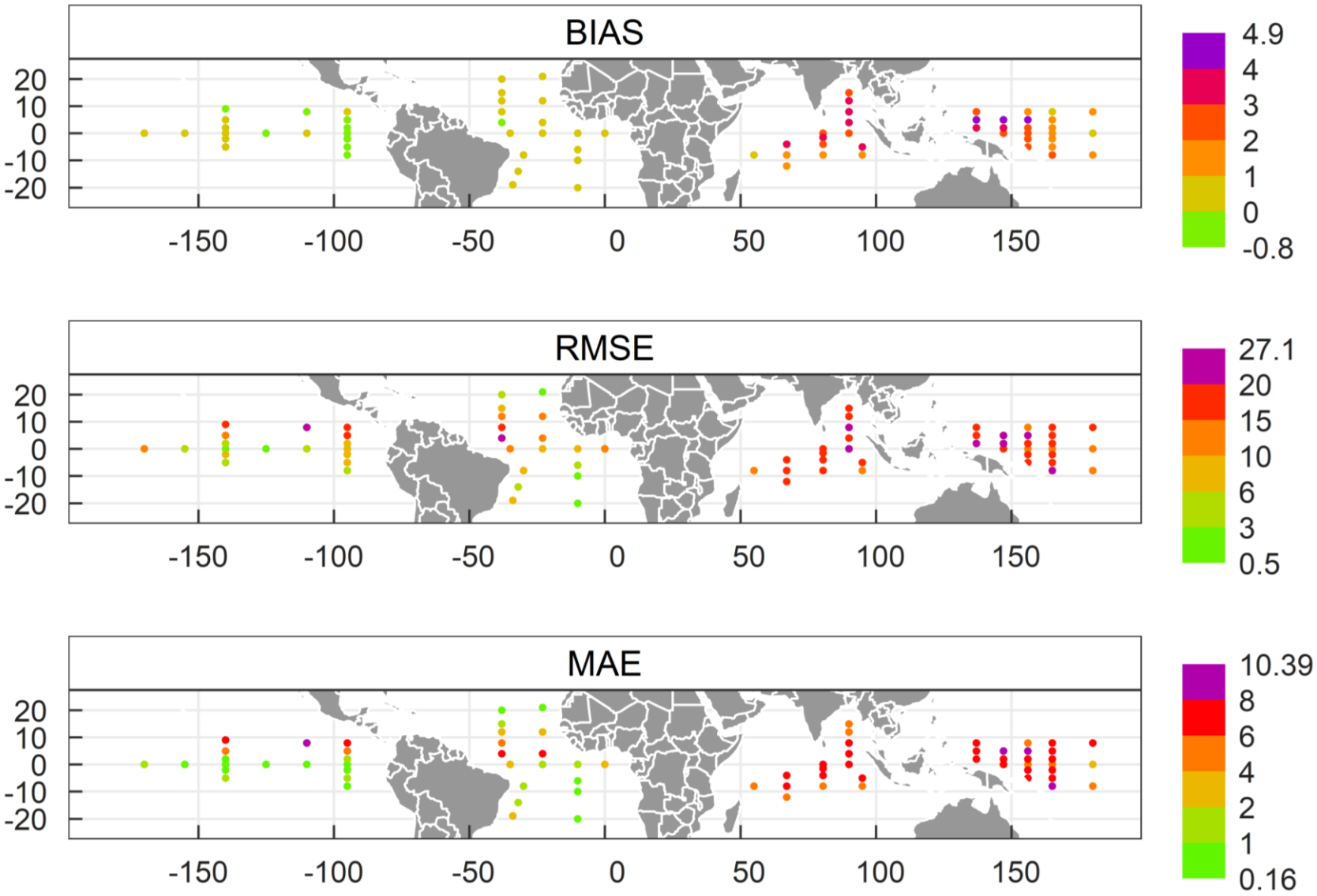



IMERG-E
IMERG-L
IMERG-F
Indian
Atlantic
Pacific
N = 5752
COR = 0.58
RMSE = 9.49
Bias = 2.64
N = 5752
COR = 0.6
RMSE = 9.81
Bias = 2.68
N = 5752
COR = 0.57
RMSE = 9.53
Bias = 2.27
N = 7305
COR = 0.52
RMSE = 3.76
Bias = 0.51
N = 7305
COR = 0.51
RMSE = 3.9
Bias = 0.51
N = 7305
COR = 0.51
RMSE = 3.73
Bias = 0.34
N = 7305
COR = 0.7
RMSE = 4.34
Bias = 1.47
N = 7305
COR = 0.71
RMSE = 4.51
Bias = 1.49
N = 7305
COR = 0.71
RMSE = 4.23
Bias = 1.26
IMERG (mm/day)
Buoys (mm/day)
0.1
1.0
10.0
100.0
count
30
20
10
25
15
5
50
40

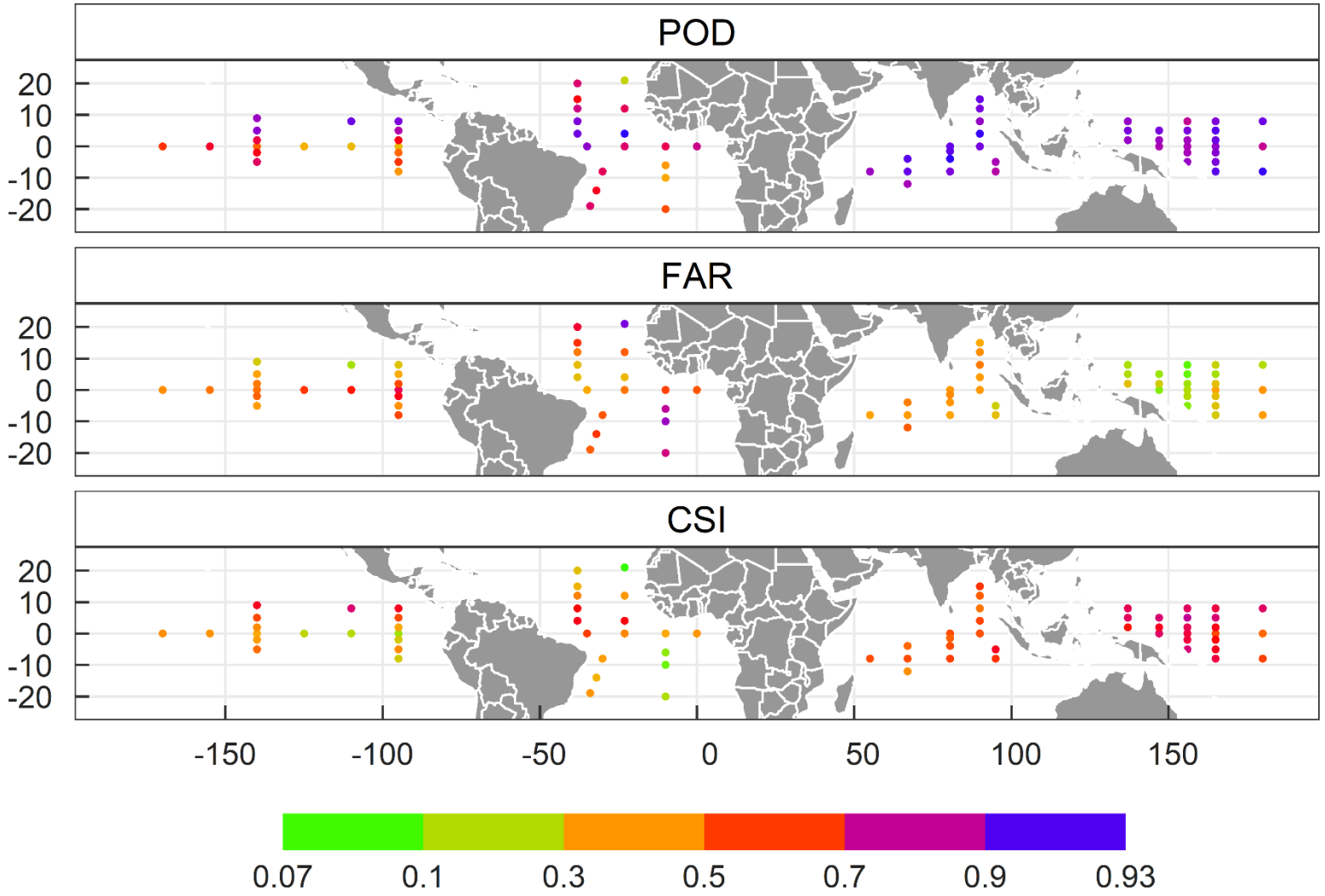
Evaluation metrics



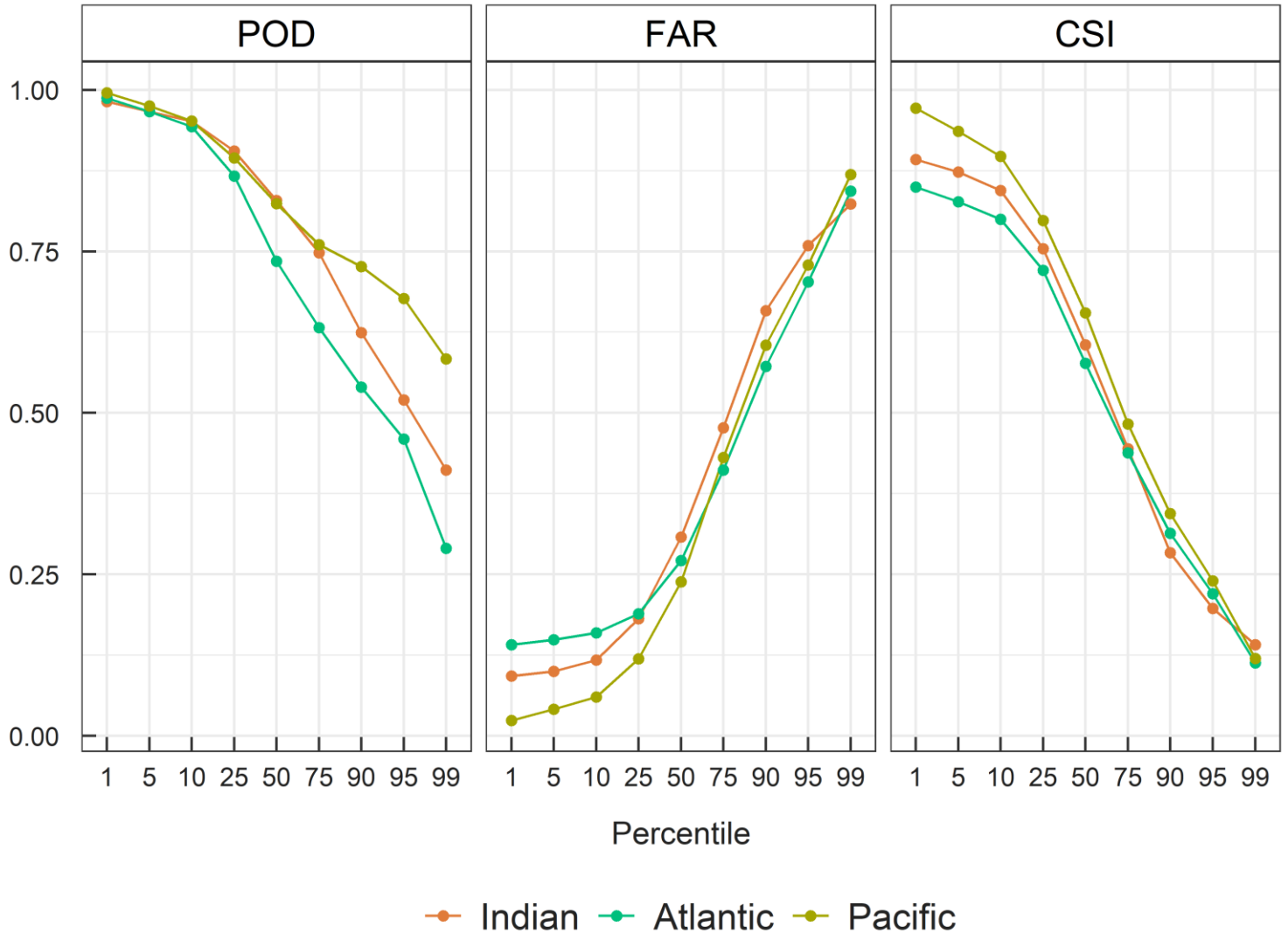
Volumetric metrics



Categorical metrics



Detection vs thresholds



Conclusions

- IMERG's better performance in reproducing spatial-temporal patterns and spatial mean precipitation.
- Very little difference among the IMERG-E, -L and –F.
- Higher overestimation, especially over the western pacific and Indian ocean.
- The detection capability of IMERG also decrease with increasing precipitation rates.
- Overall, the performance of IMERG varies with climatic conditions, geographical locations, and intensities.

Thank you for your attentation!

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References

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2. Bolvin, D. T., Huffman, G. J., Nelkin, E. J., & Tan, J. (2021). Comparison of Monthly IMERG Precipitation Estimates with PACRAIN Atoll Observations. Journal of Hydrometeorology, 22(7), 1745-1753.

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